

**U.S. DEPARTMENT OF COMMERCE
National Technical Information Service**

PB-279 016

**Proposed Expansion of Existing Wastewater Treatment
Facilities at Scottsbluff, Gering and Terrytown,
Scotts Bluff County, Nebraska**

Environmental Protection Agency, Kansas City, Missouri.

26 Jan 78

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16. ABSTRACT The proposed financial assistance under the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500) for improvement of publicly owned sewage treatment facilities in the Nebraska Panhandle Area has been determined to be a major Federal Action. The Draft EIS includes a number of alternative courses of action; including, no action, limited action (upgrading existing lagoons by structural and operational modifications) stream discharge from upgraded facilities, stream discharge from new activated sludge treatment plant, land application, and complete retention. Each alternative is evaluated with regard to cost effectiveness and environmental impacts; including, surface and ground water effects, floodplains, water use, aquatic and terrestrial biology, land use, economics, health effects, air quality, noise, aesthetics, archaeological and historic resources, recreational impacts and environmentally sensitive areas. +		
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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VII
1735 BALTIMORE
KANSAS CITY, MISSOURI 64108

January 26, 1978

TO: ALL INTERESTED GOVERNMENT AGENCIES, ORGANIZATIONS, AND CITIZENS

Enclosed with this notice is a copy of the Draft Environmental Impact Statement (EIS) for the proposed expansion of existing wastewater treatment facilities at Scottsbluff, Gering, and Terrytown, Nebraska. The EIS is submitted for your review and comment pursuant to Section 102 (2)(c) of the National Environmental Policy Act of 1969 (Public Law 91-190).

The municipalities have applied for Federal assistance in financing the proposed project(s) as provided by the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500). Comments or inquiries regarding this Draft EIS should be submitted to the above address within 45 days after the publication of notice of the document in the Federal Register, expected to be on or about February 10, 1978. Comments submitted to the Environmental Protection Agency (EPA) concerning this document and EPA's responses to those comments will be incorporated into the Final EIS.

A public hearing to solicit testimony regarding the Draft EIS will be held Wednesday, March 1, 1978, at 7:00 p.m. in the Panhandle Station Auditorium, 4501 Avenue I, Scottsbluff, Nebraska. If possible, persons wishing to testify are requested to notify this office by February 22, 1978. Those present at the hearing who wish to testify may so indicate at the hearing registration.

Additional copies of this statement are available for review in the EPA, Region VII Library, Kansas City, Missouri, and the Scottsbluff Public Library, Scottsbluff, Nebraska.

We appreciate your time and effort in reviewing this Draft EIS.

Sincerely yours,

A handwritten signature in cursive script, appearing to read "Kathleen Q. Camin".

Kathleen Q. Camin, Ph.D.
Regional Administrator

Enclosure

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EPA-7-NB-Scottsbluff -

Scotts Bluff County - WWTP-77-007

DRAFT

ENVIRONMENTAL IMPACT STATEMENT

for the

PROPOSED EXPANSION OF EXISTING WASTEWATER TREATMENT FACILITIES

at

Scottsbluff, Gering and Terrytown

Scotts Bluff County, Nebraska

Prepared by

U.S. Environmental Protection Agency

Region VII

Kansas City, Missouri

with the assistance of

Wapora, Inc.

Washington, D.C.

Approved by:



Kathleen Q. Camin, Ph.D. (Date)
Regional Administrator

DEC 13 1977

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SUMMARY

Proposed Expansion of Existing Facilities for Scottsbluff, Gering and Terrytown, Nebraska

(X) Draft

() Final

Responsible Office: U.S. Environmental Protection Agency, 1735 Baltimore, Kansas City, Missouri 64108, telephone 816/374-2921.

1. Type of Action: (X) Administrative () Legislative

2. Description of Action: The Federal action is the proposed financial assistance under the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500) for the improvements of publicly owned sewage treatment plants in Scotts Bluff County, Nebraska. Pursuant to the National Environmental Policy Act of 1969 (Public Law 91-190), Section 102(2)(c), the Environmental Protection Agency has prepared this Environmental Impact Statement (EIS) to evaluate the potential effects of these proposed actions upon the North Platte River, Scotts Bluff County, and the surrounding area.

Public hearings held by the City of Scottsbluff elucidated significant concern with regard to the City's proposal for agricultural irrigation with treated effluent. Health effects, odors, salinity, groundwater contamination, crop suitability and future reclamation of irrigated land were some of the issues discussed. The EIS responds to these issues and presents alternative wastewater treatment techniques.

A large number of wastewater treatment options are considered in this Draft EIS, and at this time no single alternative is preferred. Therefore, public input will be fully utilized to make the final decision regarding the most acceptable wastewater treatment technology.

3. Environmental Impacts: Each of the alternative treatment techniques is described in terms of its potential impact on the environment. The EIS includes assessment of the impacts upon the following:

- a. Surface water quality
- b. Surface water quantity
- c. Floodplains
- d. Water use
- e. Groundwater
- f. Aquatic biology
- g. Terrestrial biology
- h. Land use
- i. Local economics
- j. Health effects
- k. Air quality
- l. Noise
- m. Aesthetics
- n. Archeological and historic resources
- o. Recreational resources
- p. Environmentally sensitive areas

The intensity of these impacts will be dependent upon the type of alternative selected, degree of wastewater treatment and siting decisions.

4. Alternatives: The following alternative courses of action are described in detail in this statement:

- a. No action
- b. Limited action (upgrading Gering and Scottsbluff lagoons by several structural and operational modifications)
- c. Stream discharge from upgraded treatment facilities
- d. Stream discharge from new activated sludge treatment plant
- e. Agricultural irrigation
- f. Complete retention

The above alternatives are evaluated in terms of the following functional components:

- a. Flow and waste reduction
- b. Collection system
- c. Treatment plant siting
- d. Wastewater treatment processes
- e. Effluent disposal
- f. Sludge treatment and disposal

Due to the proximity of the three municipalities, regionalization alternatives are also evaluated in this statement.

5. Date Available to the Public:

6. Comments requested:

Federal Agencies

U.S. Department of Defense
 Army Engineers
U.S. Department of Health, Education and Welfare
U.S. Department of Agriculture
 Agricultural Stabilization and Conservation Service
 Forest Service
 Soil Conservation Service
U.S. Department of Commerce
 National Oceanic and Atmospheric Administration
U.S. Department of Transportation
 Federal Highway Administration
 Federal Aviation Administration
U.S. Department of the Interior
 Fish and Wildlife Service
 Bureau of Outdoor Recreation
 Bureau of Reclamation
 National Park Service
 Geological Service
U.S. Department of Housing and Urban Development
U.S. Department of Energy
 Federal Energy Administration
Advisory Council on Historic Preservation
Missouri River Basin Commission

Members of Congress

Virginia Smith, U.S. House of Representatives
Carl Curtis, U.S. Senate
Edward Zorinski, U.S. Senate

State

State Office of Planning and Programming
Nebraska Department of Environmental Control
Nebraska Department of Water Resources
Nebraska Game and Parks Commission
Nebraska Department of Health
Nebraska Natural Resources Commission
Nebraska Soil Conservation Service
Nebraska State Historical Society
Nebraska Department of Agriculture
Nebraska State Geological Survey
State Extension Forester
State Agricultural Experiment Station
Nebraska Association of Resources Districts
University of Nebraska

Local and Regional

City of Gering
City of Scottsbluff
City of Terrytown
Scotts Bluff County Health Department
Panhandle Resource Council
North Platte Valley Historical Association
Scottsbluff Public Library

Interested Groups

Nebraska Environmental Coalition
Nebraska Fisheries Society
Scottsbluff Star-Herald
Gering Courier
Business Farmer
The National Grange
National Wildlife Federation
Nebraska Wildlife Federation
Committee of Concerned Citizens
Creighton Valley-Melbeta Committee
Izaak Walton League of America, Inc.
Sierra Club
League of Women Voters
Nebraska Bass Chapter Federation
Nebraska Ornithologists' Union, Inc.
Ducks Unlimited
Audubon Society
Natural Resources Defense Council

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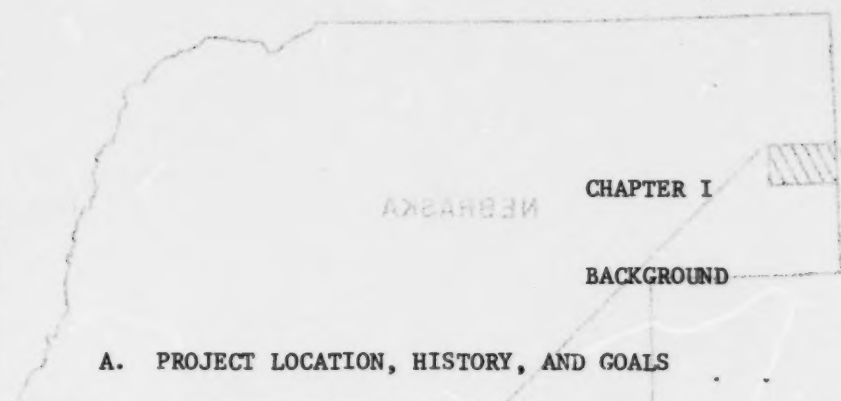
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A. PROJECT LOCATION, HISTORY, AND GOALS

1. Location

The federal action which is the subject of this Environmental Impact Statement (EIS) is the funding of improvements to three existing publicly owned wastewater treatment plants in Scotts Bluff County, Nebraska. The municipalities which own and operate these facilities are Gering, Scottsbluff, and Terrytown, Nebraska. Together these municipalities constitute the major trade and manufacturing center in the Nebraska Panhandle. The location of this urbanized area within the State of Nebraska is illustrated in Figure I-1.

The Primary Study Area considered in this EIS includes the three municipalities, their wastewater treatment facilities, and a perimeter area around the municipalities in which municipal growth might be expected to occur. Figure I-2 illustrates the municipal boundaries, their relation to the North Platte River, and the boundaries of the Primary Study Area.

Because of previous consideration given to agricultural irrigation and complete retention alternatives, a Secondary Study Area has been identified to include both previously proposed irrigation and complete retention sites and other potential sites which might provide cost or environmental advantages. The boundaries of the Secondary Study Area, locations of the previously proposed North and South irrigation sites, additional irrigation and complete retention sites considered in this EIS, and the location of the Primary Study Area are presented in Figure I-3.

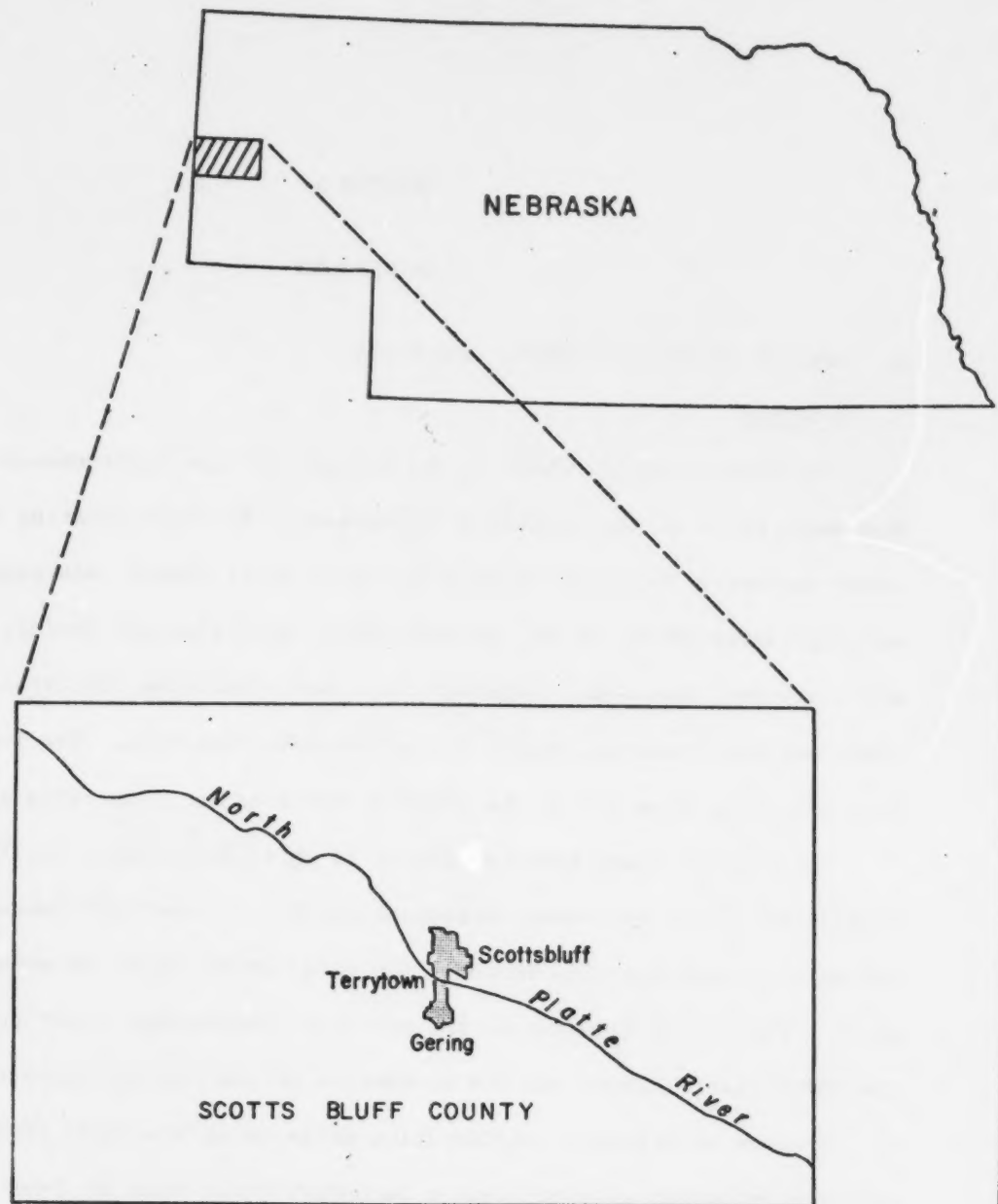
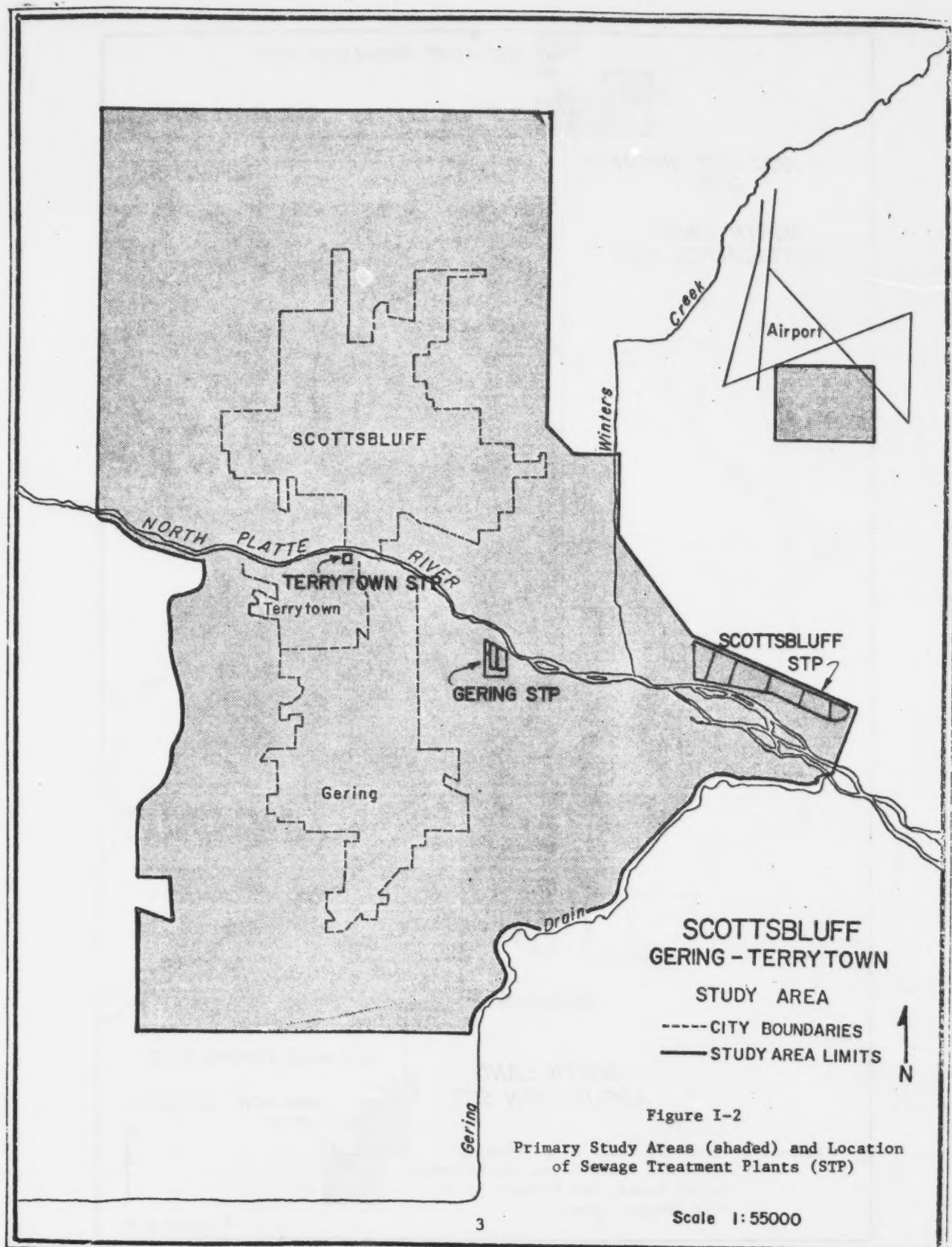
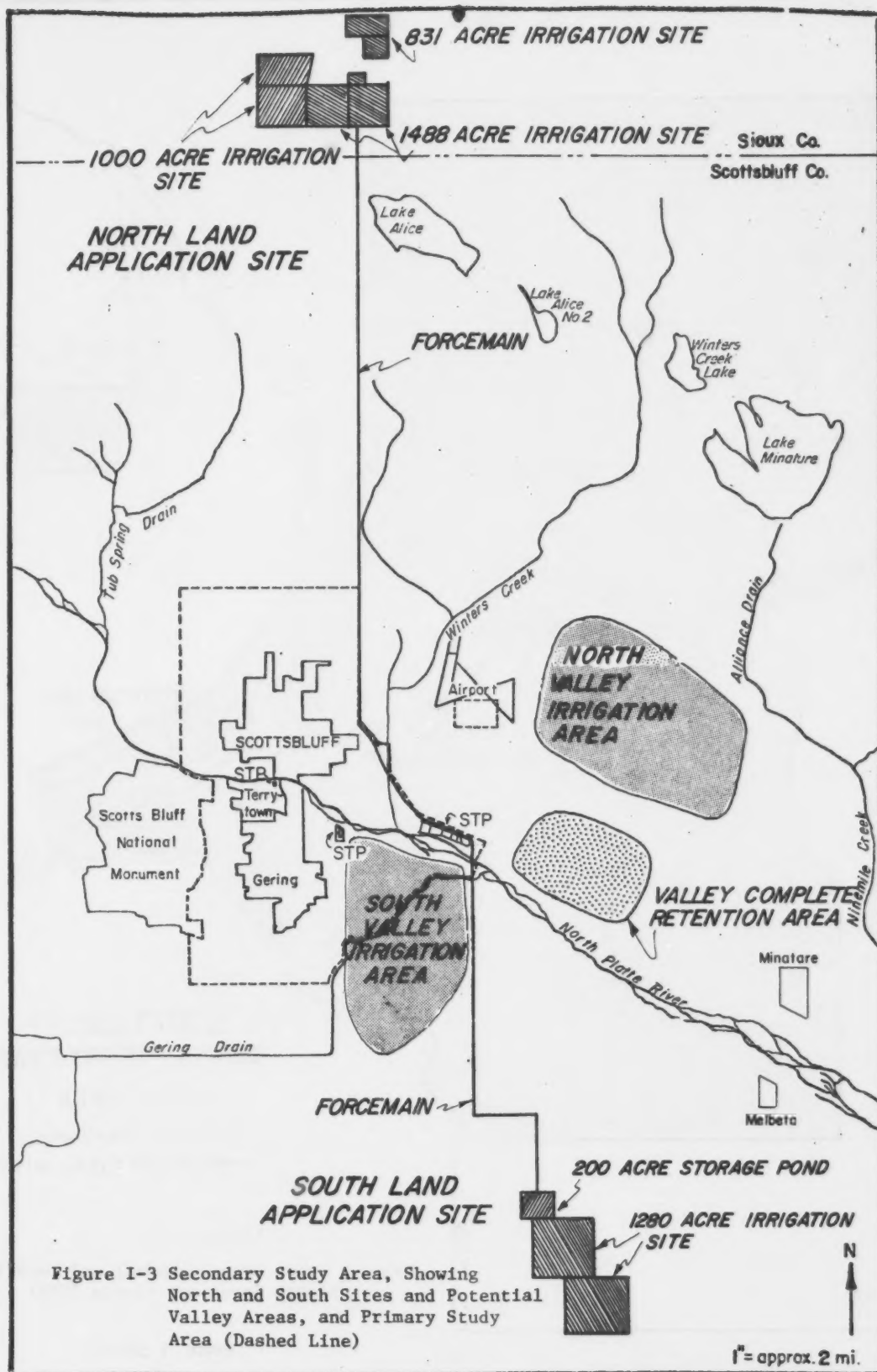


Figure I-1 Scottsbluff Urban Area in Relation to the State of Nebraska





2. Purposes of the Environmental Impact Statement

Public hearings were held in April and September of 1976 on proposals by the City of Scottsbluff to utilize sites north and south of the city for agricultural irrigation with treated wastewaters. Significant concern about these proposals was expressed by local and downstream landowners. This public controversy was voiced as questions concerning the health effects associated with system malfunctions, such as surface or groundwater contamination by viruses, intestinal parasites, or heavy metals, and the resultant effects both on cattle that eat the harvested forage and the community of Melbeta, Nebraska, which receives most of the runoff from Scottsbluff via the North Platte River. Odors, salinity, and the reclamation of the irrigated land for future agricultural use are secondary points of public concern. These and other issues that have been raised by the public are listed in Table I-1 along with the report section and page numbers where the issues raised are discussed. Comment letters received during the preparation of this draft EIS are in Appendix A.

The first purpose of this Environmental Impact Statement is to respond to this public controversy. In addition, other topics are considered so as to evaluate alternative wastewater management possibilities. These are:

- Regionalization of Scottsbluff's wastewater treatment and effluent disposal facilities with Gering and/or Terrytown
- Upgrading of existing wastewater treatment facilities in Scottsbluff, Gering, and Terrytown
- Effects of industrial pretreatment by the major meat packing firms in Gering and Scottsbluff
- Use of sites closer to the existing wastewater treatment facilities for complete retention or agricultural irrigation

Table I-1
Issues Identified as Being Points of Public Concern

Issue	Pages of EIS where Relevant Background Information and Analysis are Presented
Surface Runoff from Irrigated Crop Lands - Quantity	190, 191
Surface Runoff from Irrigated Crop Lands - Health Effects	190, 191
Groundwater Contamination from Irrigation with Treated Wastewater	46-53, 118, 208-222, Appendix F
Surface Seepage Resulting from Irrigation	208-222, especially 220-221
Odor Impacts from Irrigation with Treated Wastewater	115, 210
Crop Suitability for Agricultural Irrigation with Treated Wastewater - Human Health Effects	257-265, Appendix N
Crop Suitability for Agricultural Irrigation with Treated Wastewater - Agricultural Effects	152-156, 240-242, Appendix N
Land Areas Required for Treatment and Disposal Facilities	183-184, Appendix O
Relocation of Residences and Family Farms	238, 243-251
Renovation of Irrigation Sites	240-242
Energy and Monetary Value of Nitrogen in Wastewater	See Note #1 below
Cost Effectiveness of Complete Retention Lagoons Near Present Treatment Sites	132, 148-151, 183-184, 222-223
Cost Effectiveness of Irrigation Sites Already Acclimated to Salinity	See Note #2 below

Table I-1 (cont'd)

Cost Effectiveness of Expanding
Existing Lagoon Systems

Chapter III

Irrigation Water Management

156, 191, Appendix N,
Appendix O

Note #1: Nitrogen present in treated wastewater primarily as nitrates will avoid the necessity of crop fertilization by application of anhydrous ammonia. The value of anhydrous ammonia for fertilizing sugar beets is \$19.50 per acre per year. This savings is incorporated into agricultural irrigation alternatives costing as a reduction in crop production costs.

Note #2: Saline soil areas are caused by high water tables in the soil. Irrigation of these impermeable soils would result in marshy areas. Use of the large saline soil area north of the North Platte River for siting complete retention lagoons is considered here. Agricultural irrigation areas on the terrace above the saline soil area are also considered.

(Note: Specific sites have not been identified within the "valley areas" illustrated in Figure I-3. These areas were identified for the purpose of evaluating cost and general environmental factors associated with proximity of land application areas to existing facilities.)

3. Goals of the Section 201 Grant Action

The primary goal of the grant action taken under Section 201 of Public Law 92-500 is to bring the three publicly owned wastewater treatment plants into compliance with effluent limitations issued by the State of Nebraska, Department of Environmental Control, as mandated by the Federal Water Pollution Control Act Amendments of 1972. Effluent limitations issued by the Department of Environmental Control are equivalent to secondary treatment as defined by EPA in 40 CFR Part 133, "Secondary Treatment Information." In summary, these effluent limitations are:

NEBRASKA EFFLUENT LIMITATIONS

	<u>Weekly</u>	<u>Monthly</u>
BOD ₅	45 mg/l	30 mg/l arithmetic average
Suspended Solids	45 mg/l	30 mg/l arithmetic average
Fecal Coliform	400/100 ml	200 organisms/100 ml geometric average
pH	6.0 - 9.0 not averaged	

The Department of Environmental Control has indicated that the limitation on fecal coliform may be waived after public notice in order to avoid chlorine residuals in the North Platte River which might be harmful to rainbow trout that migrate seasonally up the river to spawn in local tributaries.

Also to be considered is the requirement of P.L. 92-500 that "best practicable waste treatment" be provided by July 1, 1983. An alternative is "best practicable" if it is cost-effective and meets the following criteria (EPA, 1975a):

a. Alternatives Employing Treatment and Discharge into Navigable Waters:

- Discharges must meet secondary treatment limitations as detailed above.
- Requirements for additional treatment, or alternative management techniques, will depend on several factors, including availability of cost-effective technology, cost, and the specific characteristics of the affected receiving water body.

b. Alternatives Employing Land Application Techniques and Land Utilization Practices:

- Discharge must meet the criteria for Treatment and Discharge
- Groundwater resulting from the land application of wastewater, including the affected native groundwater, shall meet the following criteria:

(1) Standards for chemical quality, bacteriological quality, and pesticides specified in the EPA Manual for Evaluating Public Drinking Water Supplies (included as Appendix B) should not be exceeded.

(2) Land application of wastewater should not increase the concentration of a parameter which already exceeds standards for chemical quality or pesticides.

c. Alternatives Employing Reuse

- The total quantity of any pollutant in the effluent from a reuse project which is directly attributable to the effluent from a

publicly owned treatment works shall not exceed that which would have been allowed under Paragraphs A and B above.

Complementing federal goals are State of Nebraska priorities for stream quality improvements, and for improving municipal wastewater treatment facilities. A ranking of municipal wastewater treatment priorities in the North Platte River Valley was made by the Nebraska Natural Resources Commission (1975). Within the ranking, which included 14 priority categories, the three municipal facilities in the Primary Study Area rated as follows:

<u>Municipality</u>	<u>North Platte River Valley Priority Ranking</u>	<u>State Priority Ranking</u>
Scottsbluff	1	8
Gering	5	11
Terrytown	10	132

Current state priority rankings are also shown.

The State of Nebraska Department of Environmental Control has authority for the National Pollutant Discharge Eliminating System program in the state, and is therefore the permitting agency for the federally sponsored actions considered in this Environmental Impact Statement. The U.S. Environmental Protection Agency, Region VII, is the sponsoring federal agency.

4. History of the Construction Grant Application

A substantial amount of consideration has been given to the wastewater management needs of the Primary Study Area prior to and during the preparation of this Environmental Impact Statement. The following is a chronology of events in its consideration:

- 1972 - Abatement program ordered by Nebraska Department of Environmental Control for the City of Scottsbluff wastewater treatment facilities

- April, 1972 - Engineering study of wastewater treatment alternatives, "Report on Waste Water Treatment Requirements," completed by M. C. Schaft and Associates, Henningson, Durham, and Richardson. Activated sludge treatment with discharge to the North Platte River was recommended for the Proposed Action.
- November, 1973 - "Study and Report: Waste Treatment Facilities, Scottsbluff, Nebraska, completed by Bell, Galyardt, and Wells, Inc.
- March, 1974 - Step I, Facilities Planning Grant awarded to the City of Scottsbluff. Bell, Galyardt, and Wells, Inc., contracted to conduct the study.
- February, 1974 - City of Scottsbluff decided to reconsider spray irrigation alternatives.
- March, 1974 - "Supplementary Study and Report: Waste Treatment Facilities, Scottsbluff, Nebraska," completed by Bell, Galyardt, and Wells, Inc.
- May, 1974 - "Scottsbluff, Nebraska Waste Treatment Facilities Cost Effectiveness Analysis" completed by Bell, Galyardt, and Wells, Inc.
- September, 1974 - Infiltration/Inflow study for the City of Scottsbluff initiated. Work performed by Bell, Galyardt, and Wells.
- May, 1975 - Infiltration/Inflow study completed.
- September, 1975 - Scottsbluff Facilities Plan submitted recommending spray irrigation at the South Site as the Proposed Action.
- February, 1976 - "Environmental Assessment: Wastewater Irrigation Facilities, Scottsbluff, Nebraska" completed by Bell,

- Galyardt, and Wells, Inc., considering spray irrigation at the South Site.
- April, 1976 - First public hearing on the Facilities Plan. Considerable public opposition to spray irrigation at the South Site was expressed by local citizens.
- May, 1976 - Environmental Impact Statement process initiated by Region VII, U.S. Environmental Protection Agency.
- August, 1976 - "Environmental Assessment: Wastewater Irrigation Facilities: North Site, Scottsbluff, Nebraska," completed by Bell, Galyardt, and Wells, Inc.
- September, 1976 - Second public hearing on the Facilities Plan. Considerable public opposition to spray irrigation at the North Site was expressed by local citizens.
- September, 1976 - WAPORA, Inc., contracted by Region VII, U.S. E.P.A. to prepare Draft and Final Environmental Impact Statements on the Scottsbluff Facilities Plans.
- February, 1977 - Draft copies of Facilities Plans for Gerying and Terrytown, Nebraska, submitted by Bell, Galyardt, and Wells, Inc.
- July, 1977 - "Amendment No. 1 to Facilities Plan of August, 1975 - Dissolved Air Flotation - Scottsbluff, Nebraska" prepared by Bell, Galyardt, and Wells, Inc.

B. EXISTING FACILITIES

Three municipally owned wastewater treatment facilities are located in the Primary Study Area.

- The City of Scottsbluff's six-celled stabilization lagoon system is located in the floodplain approximately 1.7 miles east of the city, between U.S. Route 26 and the North Platte River. Coarse screening, flow metering, and sewage lift and distributing facilities precede the six lagoons. Effluent discharge is to the North Platte River from each of three pairs of lagoons. Effluent quality does not meet applicable effluent limitations due to inefficient distribution of the flow and organic loads, and to organic overloading. Domestic and industrial flows are combined in the interceptor sewers. The major industrial contributors are Flanery Foods, Inc., a meat packing facility, and CRA, Inc., a petroleum refinery. Due to overloading and inefficient operation of Scottsbluff's lagoon system, the Nebraska Department of Environmental Control has not been giving routine approval of new sewer construction, but reviews applications on a case-by-case basis.
- The City of Gering stabilization lagoon system is located less than one-half mile east of the city, and immediately east of complete retention lagoons owned by the Great Western Sugar Company, and partially in the flood plain of the North Platte River. Inoperative flow metering and comminutor equipment precedes a raw domestic wastewater lift station which discharges to a series of two stabilization lagoons. Inoperative coarse screening and flow metering equipment precedes a raw industrial (meat packing) wastewater lift station

which discharges to a series of lagoons including three anaerobic lagoons, three aerated lagoons, and two stabilization lagoons.

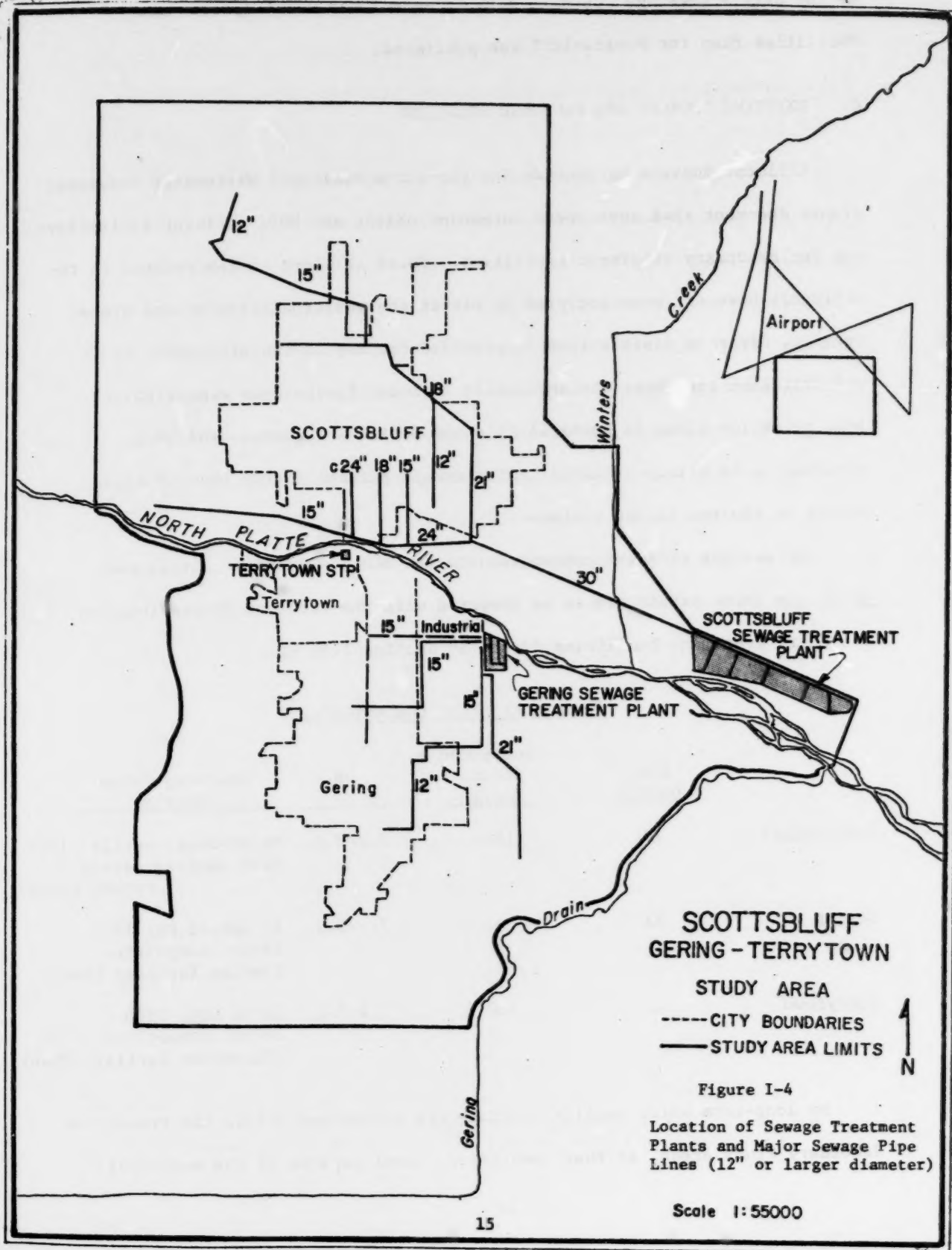
Domestic and industrial wastewaters flow through a common final lagoon to a single effluent structure and then a short canal to the North Platte River. Effluent quality only marginally exceeds effluent limitations despite heavy organic loading of the stabilization lagoons.

- The Village of Terrytown owns and operates an activated sludge wastewater treatment plant which is designed to utilize the extended aeration process. It is located in the village and is bounded on the north by the North Platte River, on the east by Nebraska Highway 71, and on the south and west by the residential and commercial development of the village. The plant is in the floodplain, but is diked against flood waters. It is adequately sized to handle design year wastewater flows and loads, but operational problems, especially the treatment and disposal of excess activated sludge, result in high suspended solids and BOD concentrations in the plant's effluent. Disposal of excess activated sludge on the flood plain has been reported.

Figure I-4 shows the locations of the three municipal wastewater treatment facilities and the major interceptor sewers in Scottsbluff and Gering.

Besides the three municipal discharges there are 25 other water pollution sources inventoried within the Primary and Secondary Study Areas. These include industrial discharges, irrigation return flows, and feedlots.

(Nebraska Natural Resources Commission, 1975). These non-municipal sources are identified in Appendix C. CRA, Inc., the petroleum refinery in Scottsbluff and the only non-municipal pollution source identified in Appendix C which is involved in the federally funded actions considered here, has since entered into an agreement with Scottsbluff to discharge its lagoon effluents



to the city's sewerage system. This agreement was reached after the Facilities Plan for Scottsbluff was published.

C. EXISTING PROBLEM AND PROPOSED SOLUTIONS

Effluent monitoring records for the three municipal wastewater treatment plants document that none meets suspended solids and BOD₅ effluent limitations set for secondary treatment facilities. Fecal coliform concentrations in the effluents have not been analyzed by either the municipalities or the state. However, since no disinfection is provided for any of the effluents, it is unlikely that they meet the applicable effluent limitations even with the long retention times in Scottsbluff's and Gering's lagoons. The pH is expected to be within accepted limits except perhaps during intense algal blooms in the two lagoon systems.

The average effluent concentrations for BOD₅, suspended solids, and pH at the three plants are to be compared with the effluent limitations for secondary treatment facilities listed in Section I.A. 2.:

AVERAGE EFFLUENT CONCENTRATIONS

	<u>BOD₅</u> <u>(mg/l)</u>	<u>Suspended</u> <u>Solids</u> <u>(mg/l)</u>	<u>pH</u>	<u>Sampling Dates</u> <u>(Source)</u>
Scottsbluff	77	105	7.6-8.5	March-Sept. weekly, 1976 Grab samples (state report forms)
Gering	33	67	7.4-8.3	27 Apr.-1 May 1976 24-hr. composites (Gering Facility Plan)
Terrytown	42	102	7.2-7.5	18-22 May, 1976 24-hr. composites (Terrytown Facility Plan)

No long-term water quality stations are maintained within the Primary or Secondary Study Areas, so that quantified, local impacts of the municipal

effluent discharges cannot be described. Water quality data from long-term U.S. Geological Survey stations at the Wyoming-Nebraska state line (23 miles above the Primary Study Area) and at McGrew, Nebraska (12 miles below the Primary Study Area) show that North Platte River water quality meets current Nebraska water quality standards. The North Platte River in the study areas is classified for "Partial Body Contact."

There is no evidence that the existing discharges are harmful to the aquatic biota of the North Platte. One of the most sensitive of freshwater fish, the rainbow trout, migrates twice a year through the mixing zones below these discharges to reach spawning beds in local tributaries. The fish migrate in spring and fall from Lake McConaughy when river flows are normally in excess of average yearly flows. The migration of trout is not, therefore, an indicator of aquatic community health during low flow periods. Aquatic biology surveys have not been conducted on this segment of the North Platte River. The effect of pollution discharges on the aquatic community cannot, therefore, be accurately assessed.

The water quality problem which is the basis for federal, state, and local action is failure of the existing wastewater treatment facilities to meet national and state standards for secondary treatment.

The most recently proposed actions for remedying these standard violations by municipality are:

- Scottsbluff -- The August, 1975, Facilities Plan for Scottsbluff did not recommend a proposed action. Subsequent to its publication, however, environmental assessments for agricultural irrigation by center pivot at a south site and a north site (see Figure I-3) were prepared and separate public hearings were held for these proposed actions. Considerable public controversy over the impacts of these proposed actions precipitated EPA's decision

to prepare an Environmental Impact Statement. Since initiation of the EIS process, Scottsbluff has contracted with its consulting engineers, Bell, Galyardt, and Wells, Inc., to develop an alternative which includes upgrading the existing lagoon system and adding dissolved air flotation of the effluent prior to discharge to the North Platte River.

"Amendment No. 1" to the Scottsbluff Facilities Plan was submitted to the City in July, 1977. This study found that upgrading the existing lagoon system, constructing a 120-day storage lagoon, and providing dissolved air flotation of lagoon effluent jointly with Gering's lagoon effluent was more cost-effective than agricultural irrigation.

- Gering -- A preliminary draft of the Gering Facilities Plan dated 21 January 1977 recommended upgrading the existing lagoon system and adding dissolved air flotation of the effluent prior to discharge to the North Platte. Major features of the lagoon upgrading were commitment of the existing lagoon system to treat meat packing wastes, construction of a new 40-acre lagoon for treating domestic wastes and construction of a new 90-acre pond for winter storage of lagoon effluent. The Gering Facility Plan considered incorporating Terrytown's projected wastewater flows into the various alternatives considered.

- Terrytown -- A preliminary draft of the Terrytown Facilities Plan recommended modification of the existing activated sludge treatment plant to enable it to provide secondary treatment. Modifications included addition of an aerobic sludge digester for sludge stabilization and storage, providing chemical feed equipment for use during plant upsets, extending the existing lab and blower housing to accommodate the new equipment, and addition of new automatic flow measurement equipment.

These proposed actions, most of the previously proposed alternatives, and feasible means of regionalizing municipal wastewater management within the Primary Study Area, are evaluated in detail in this EIS.

D. COST-SHARING

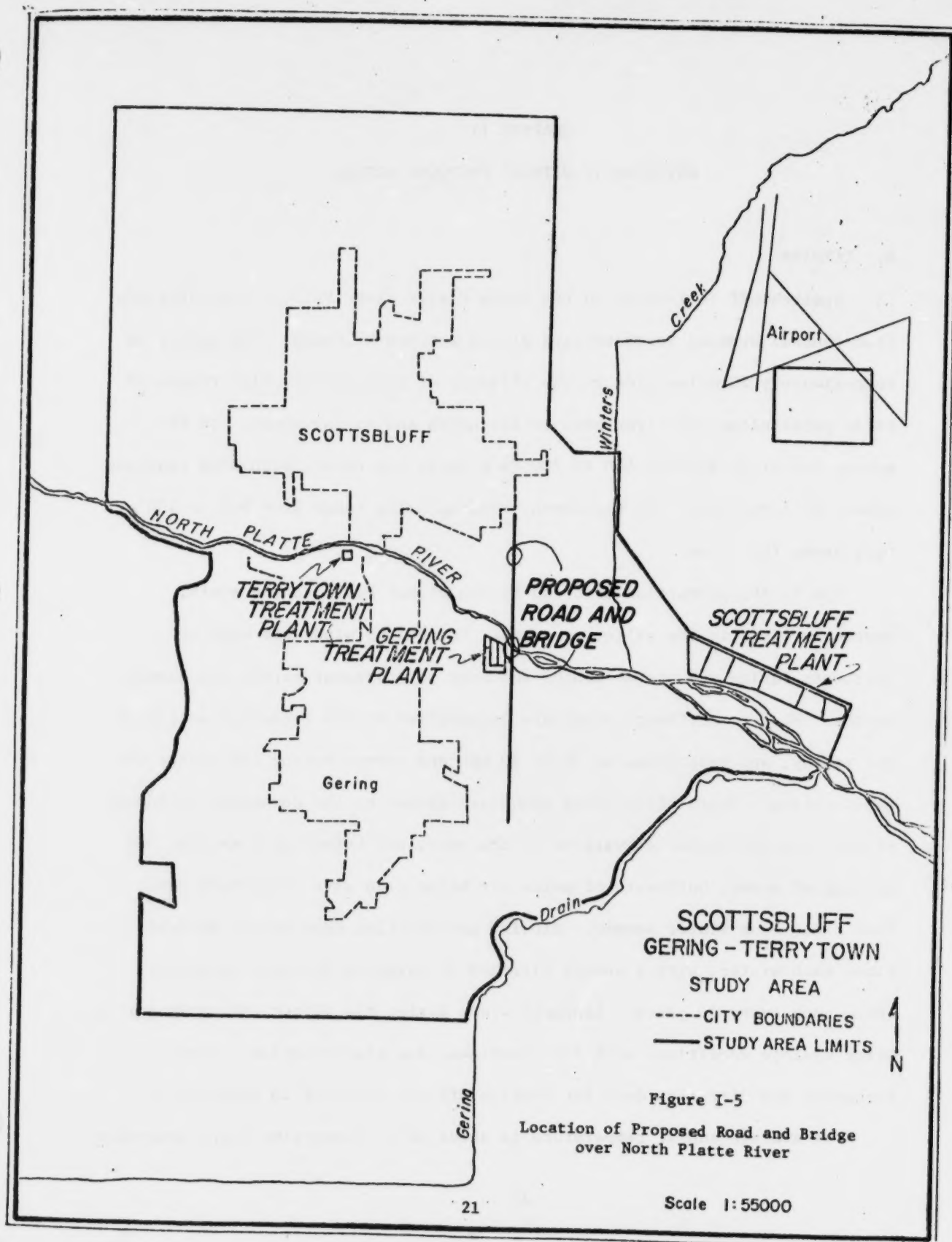
The federal government, through Region VII EPA's Construction Grants Program, provides 75 percent of eligible capital costs for upgrading existing facilities or construction of new facilities.

The State of Nebraska, through its Department of Environmental Control, provides an additional 12.5 percent of eligible capital costs. The remaining 12.5 percent and all operation and maintenance costs are borne by the local municipalities. The federal, state, and local shares of the many system and regional alternatives considered here are listed by alternative on page 259.

E. CONCURRENT ENVIRONMENTAL ACTIONS

Region 7 of the Federal Highway Administration and the Nebraska Department of Roads jointly published a Final Environmental Impact Statement in July, 1976 (Federal Highway Administration and Nebraska Department of Roads, 1976), considering the construction of a new highway bridge across the North Platte River east of Gering and Scottsbluff. The location of the proposed bridge and highway is shown in Figure I-5.

Transportation of raw sewage or treated effluent across the flood plain, associated wetlands, and channel of the North Platte River is an element of several regional and system alternatives discussed in the present EIS. The adverse impacts of constructing force mains or siphons under the North Platte River might be avoided by use of the bridge as a supporting structure. Correspondence related to possible use of the proposed bridge is reproduced here in Appendix D.



CHAPTER II

ENVIRONMENT WITHOUT PROPOSED ACTION

A. CLIMATE

Scottsbluff is located in the North Platte River Valley, which extends from central Wyoming southeastward across western Nebraska. The valley is approximately 20 miles wide in the vicinity of Scottsbluff, with ranges of hills paralleling the river both to the north and to the south. To the south, the hills average 600 to 700 feet above the river, with some reaching upward to 1,000 feet. To the north, rolling hills range from 300 to 400 feet above the river.

Due to the protection afforded by the higher hills to the south, southerly winds in the valley are rare. Prevailing winds are west to northwest during the winter months and east to southeast during the summer months. West to northwest winds are intensified by the funneling action of the valley, and velocities of 30 to 50 mph are common during the winter and early spring. Quite often these winds are warmed by the downslope (chinook) effect from the higher elevations to the west, and bring rapid warming and melting of snow. Outbreaks of polar air bring cold wave conditions about five times each winter season. Blowing and drifting snow occurs several times each winter, with a severe blizzard of extended duration occurring about once every 30 years. Easterly winds during the winter and early spring bring upslope conditions with low cloudiness and precipitation. Wind frequency and direction data for Scottsbluff are included in Appendix E.

The average annual temperature is about 48°. Summertime highs generally

range from the 80's to the 90's, with lows of about 60°. In winter, highs average about 40°, with lows of 15° to 20°. A 100° temperature is recorded about one time each summer, and the temperature drops to zero or below about 15 times each winter.

The Scottsbluff climate is semiarid, with an average annual precipitation approximating 15 inches. Most of the precipitation occurs as thundershowers during the spring and summer months. The average annual snowfall is about 37 inches, with the greatest average monthly snowfall occurring in March. Low relative humidities are common during summer and early fall, with values frequently dropping below 15 percent during the warmest portion of the day. Temperature, precipitation, relative humidity, and wind data are shown in Table II-1.

Severe thunderstorms with destructive hail are common during the late spring and early summer, but tornadoes are infrequent.

The North Platte River in the vicinity of Scottsbluff is a wide shallow stream and has little effect on the temperature and humidity in the surrounding area (National Climatic Center, Undated).

B. TOPOGRAPHY AND PHYSIOGRAPHY

1. General

The study area is part of the High Plains, an area that has been extensively eroded. During Tertiary time, streams that drained the ancestral Rockies deposited immense quantities of debris (gravel, sand, silt, and clay) on an extensive alluvial plain that stretched hundreds of miles northward along the flanks of the mountains and eastward toward the Mississippi River. As sediments accumulated, the elevation of the alluvial surfaces was in excess of 5,000 feet above sea level in the Scottsbluff

Table II-1
TYPICAL CLIMATOLOGICAL DATA FOR SCOTTSBLUFF

Month	Mean Temp. (°F)		Mean No. of Days		Precipitation		80% Chance		Relative Humidity (%) vs. Time			Lake		Mean Wind	
	Max	Min	Max	Min	Average (in)	Yearly Avg. (in)	Yearly Occurrence (in)	Wet Year (in)	5 am	11 am	5 pm	11 pm	Evaporation (in/mo)	Speed (mph)	Direction
January	24.9	9	29		0.32	2.2	.48	0.21	75	58	58	73	2.00	10.7	WNW
February	29.5	6	27		0.33	2.3	.51	0.28	75	53	49	71	3.00	11.4	WNW
March	34.3	4	27		0.76	5.2	1.15	0.60	76	49	44	69	5.01	12.4	WNW
April	46.2	0	14		1.52	10.4	2.29	1.28	76	46	41	66	6.24	12.8	NW
May	56.5	0	2		2.81	19.3	4.25	1.92	78	44	40	66	7.89	12.1	ESE
June	65.9	0	0		3.36	23.1	5.08	2.21	79	45	41	69	8.13	-0.6	ESE
July	73.7	0	0		1.76	12.1	2.66	1.02	80	42	37	68	9.25	9.3	ESE
August	71.6	0	0		0.95	6.5	1.43	0.72	80	43	37	67	8.76	9.1	ESE
September	61.2	0	2		1.15	7.9	1.74	0.87	80	44	39	69	5.87	9.5	ESE
October	50.2	1	13		0.82	5.6	1.23	0.49	76	44	41	66	3.57	9.7	NW
November	36.2	3	27		0.39	2.7	0.59	0.33	77	52	51	70	1.75	10.4	NW
December	27.6	8	30		0.40	2.7	0.59	0.29	75	57	58	72	1.00	10.7	WNW
Annual	48.2	31	173		14.57	100.0	22.00	10.22	77	48	45	69	62.47	10.7	ESE

^a The wettest year in 25 years was determined by inspection of historic rainfall records to be approximately 22 inches. This total was allocated to individual months according to the "% of yearly average" figures in the previous column and use in calculating design volumes of storage lagoons.

^b (U.S. Department of Agriculture, 1972) There is an 80 percent chance that at least this much rainfall will occur in each month. These figures were used to calculate crop requirements for irrigation water.

region (Wenzel and others, 1946).

Subsequent to deposition of these sediments, many of the streams that were responsible for deposition of these sediments became active agents of erosion and transportation during the latter part of the Tertiary Period and the Quaternary Period. The North Platte River, the major river in the study area, is situated in a valley that is as deep as 1,000 feet in Scotts Bluff County. The valley walls form steep, nearly vertical slopes in some areas which are flanked by river terraces, particularly north of the North Platte River.

Nine depositional terrace levels that generally are capped by river gravels were identified by Wenzel and others (1946) north of the river where the gently sloping land surface is broken by a succession of steeper slopes that parallel the river. South of the North Platte River prominent escarpments, some of which rise almost vertically for several hundred feet from the otherwise flat areas, are erosional escarpments (terraces) produced by lateral erosion of streams when they were at higher elevations. Depositional terraces are few and not prominent south of the river in the project area.

The Tertiary Formations exposed in the study region are not uniformly resistant to erosion. The North Platte River has cut through more than 1,000 feet of sediments in the Scottsbluff region. The upper sandstones of the Arikaree Group, and to a lesser extent, the Gering Formation, contain hard concretionary zones so that they are relatively resistant to erosion and form the uplands and prominent bluffs. The lower Brule Formation is relatively less resistant, so that fewer bluffs or escarpments, except along the valley walls of the river, occur within this formation. Badland topography is characteristic of areas where the Brule Formation forms steep slopes.

Wind also has affected the topography of the study region. Loess is

reported to occur as a thin veneer of sediment 4 to 5 feet thick on nearly all flat, undisturbed areas (Wenzel, 1946). Sand dunes also are randomly distributed and numerous in the study area except in areas of steep slopes or active erosion.

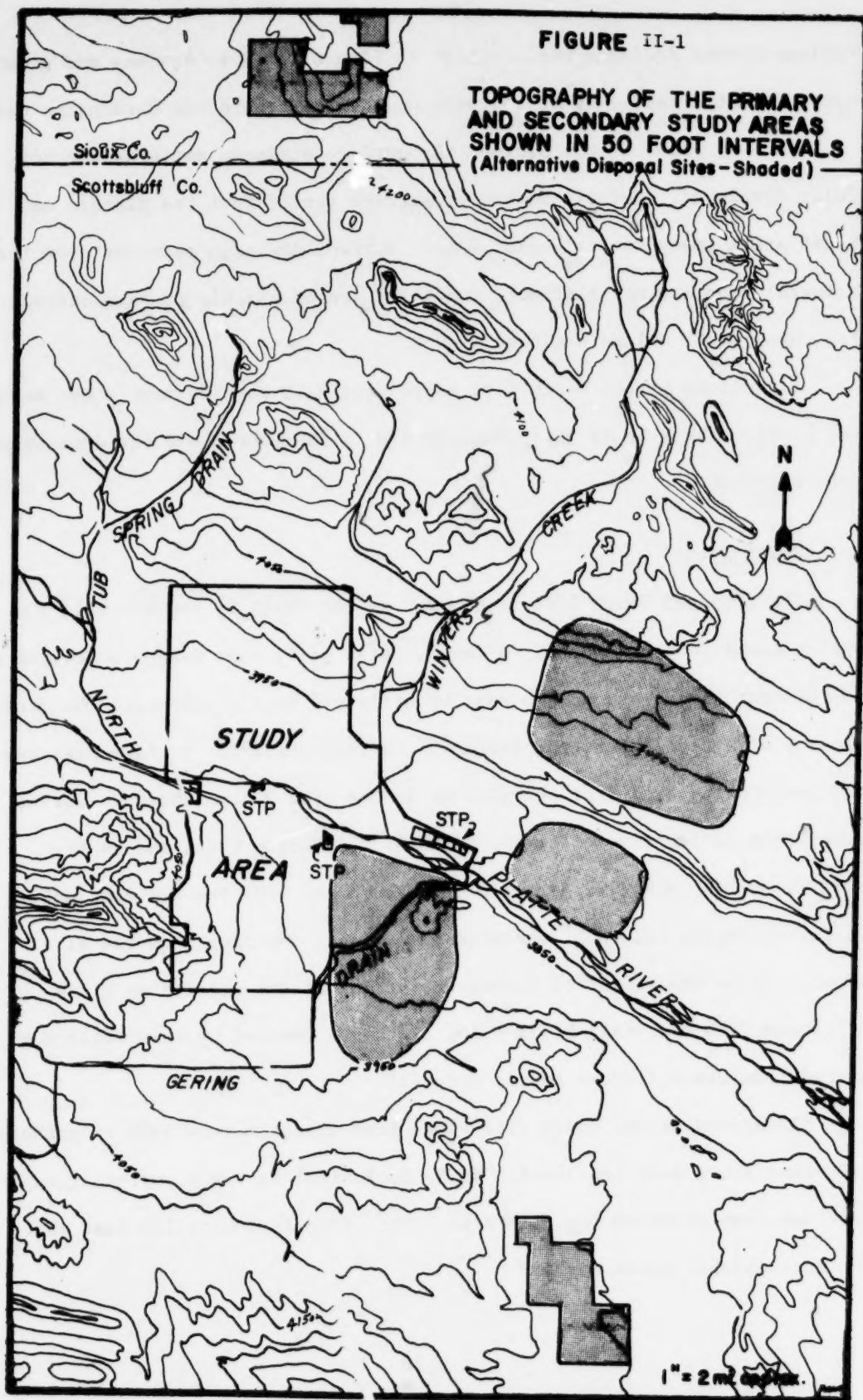
Scottsbluff, Gering, and Terrytown are located on relatively level land adjacent to the North Platte River, at elevations of 3900 to 3950 feet above mean sea level. Maximum relief within the Primary Study Area is found west of Gering at the foot of Scottsbluff National Monument and north of Scottsbluff at the escarpment of the third river terrace.

Outside of the Primary Study Area moderate relief is provided by remnants of depositional river terraces within the river valley north of and oriented parallel to the river. These remnants are steep enough in some locations to preclude irrigation by the canal system. More dramatic relief occurs along bluffs at the northern and southern borders of the river valley. The river valley south of the North Platte River is intersected by two eroded bluff formations oriented perpendicular to the river. Scotts Bluff is the most prominent of these within the Secondary Study Area. A more severely eroded bluff area forms the eastern boundary of Cedar Valley.

Topography of the Primary and Secondary Study Areas is shown in Figure II-1.

2. North Site

The proposed North Site is located at the edge of the bluff area separating the plateau from North Platte River Valley. A finger of the plateau surrounded by bluffs on the west, south, and east extends into the center of this site. A distinct topographic, and probably hydrologic, divide intersects the site so that surface and groundwater on the west side of the site (Sections 23, 26, and half of 25) would flow into the Wind



Springs Creeks drainage basin. (Refer to Figure III-9.) Surface and groundwater from the east side of the site would flow toward the Enterprise Canal. On both sides of the divide, the surface drainage patterns are not fully developed. Gullies formed by surface runoff from the plateau and bluff areas empty onto alluvial fans. Surface drainage patterns over the alluvial fans are not distinct, and there are no visible surface outlets for these small upland drainage basins.

Elevations at the North Site range from 4220 to 4580 feet above mean sea level. The site is approximately 370 to 730 feet above the Scottsbluff lagoon system.

3. South Site

The proposed South Site is bounded on the north by the Mitchell and Gering Canal, on the south by a deep erosion gully that drains a portion of the Wildcat Hills, and on the west by hills and knolls which are the eroded remains of a bluff formation analogous to Scotts Bluff. Surface drainage and groundwater flow from the site is to the east and northeast. Surface water flow is intercepted by the Mitchell and Gering Canal and by the erosion gully. Minor topographic divides on the site are not distinct. (Refer to Figure III-10.) Somewhat hilly local topography on the site appears to be the result of uneven weathering of the underlying Brule Siltstone with the small hills being siltstone covered by thin soils weathered from the siltstone parent material.

Elevations at the South Site range from approximately 3950 to perhaps 4000 feet above mean sea level. (U.S. Geological Survey topographic maps have not been prepared for this area.) This site is 100 to 150 feet above the Scottsbluff lagoon system.

4. North Valley Irrigation Area

While specific sites are not designated within this area, the physiography and topography are uniform throughout. The area lies entirely upon the third river terrace north of the North Platte. The land surface is nearly level to gently sloping in a southerly direction. The entire area is intersected by irrigation canals and drainage ditches that support intense agricultural use of the land. These man-made improvements have undoubtedly replaced natural drainage patterns.

Elevations in this area range from 3920 to 4020 feet above mean sea level, or 70 to 170 feet above the Scottsbluff lagoon system.

5. South Valley Irrigation Area

This area covers portions of Cedar Valley adjacent to the North Platte River flood plain. Gering Drain passes through the area. The area is nearly level to gently sloping, with the exceptions of excavated slopes adjacent to the Drain and a large hill directly south of the Scottsbluff lagoon system. Surface drainage within this area is controlled by local irrigation canals and drainage ditches, except for some parts which may drain directly to the North Platte River.

Elevations in this area range from 3850 to 3920 feet above mean sea level, or 0 to 70 feet above the Scottsbluff lagoon system.

6. Valley Complete Retention Area

This area is located entirely within the first river terrace north of the river. The area is crossed on section lines by drainage ditches originating on the higher third terrace. The Minatare Canal passes through, and Winters Creek Canal passes just north of, the area. This area is flat with poor surface drainage.

Elevations in the Valley Complete Retention Area are between 3620 and 3640 feet, between 10 and 30 feet below the base of the Scottsbluff lagoon system.

C. GEOLOGY

The geology of Scotts Bluff County is characterized by gently eastward dipping sandstones, siltstones, and claystone of Tertiary age which were deposited on the eroded surface of Cretaceous strata. Rocks of Tertiary age predominate the surficial geology of Scotts Bluff County and the southern portion of Sioux County. Outcrops of Cretaceous rocks are restricted to small areas along the Wyoming-Nebraska border and are not found in the study areas. The geologic formation of the Cretaceous and Tertiary systems will be described sequentially, beginning with the oldest. Geographic distribution of these rock units is shown on the geologic map, Figure II-2. This figure illustrates the basal geology only and does not identify the significant sand and gravel deposits underlying the North Platte River and overlying the older formations as terraces to the north of the river.

1. Cretaceous System

a. Lance Formation

The Lance Formation crops out only in the western part of Scotts Bluff County, but it underlies Tertiary strata throughout the study region. Well data indicate that the Formation is as much as 120 feet thick and dips eastward at an average rate of 16 feet/mile. The Lance Formation consists of an alternating sequence of nonmarine grey, brown, and yellow-brown sandstones and pink, yellow, red, and brown clays.

The Lance Formation is overlain unconformably by Tertiary nonmarine strata which are relatively impermeable. Consequently, the sands within the Lance Formation yield small to moderate quantities of water for domestic and stock purposes. Due to downdip of the outcrop area in the western part of the county, the sands become confined and some wells are reported to be free-flowing (Wenzel and others, 1946).

2. Tertiary System

a. White River Group

The White River Group consists of the clay- and silt-sized sediments which underlie the bottom and lower slopes of the North Platte River Valley. The Chadron Formation and overlying Brule Formation are the most widely distributed strata in the study area. They originally were differentiated on faunal differences but lithologic differences between the two formations also are evident.

Chadron Formation -- The Chadron Formation is composed primarily of green and brown plastic clay which grades upward into a light green silty clay or clayey silt. The uppermost part of the light green, silty-clay facies approaches the composition of the lower portion of the Brule Formation, which it underlies. Although buried sand and gravel channels are distributed throughout the Formation elsewhere, they are not abundant in the study area. The Chadron outcrops in the study area along or near the North Platte River.

The Chadron Formation is probably a reworked volcanic ash, deposited in floodplains by streams, and scattered and redeposited by winds. Basal beds of the Chadron are plastic, well sorted, unconsolidated clays, and are easily weathered and eroded into flat slopes (Wenzel and others, 1946). The

Chadron formation provided parent material for Orella and Buffington soils (Yost and others, 1968).

Brule Formation -- The Brule formation is exposed throughout much of Scotts Bluff County, and is a ruddy-buff or flesh-colored silt which, although massive and featureless in fresh exposures, weathers into blocks or slabs over time. At Scotts Bluff National Monument, more compact or more limey sediments within the Brule have been weathered into badlands. The estimated thickness of the formation in the Scotts Bluff-Gering area is 560 feet.

The Brule is composed of reworked volcanic ash and calcite crystals deposited as an alluvium, and reworked by the wind. Three parts of the Formation are recognized in Scotts Bluff County. The lower part of the Brule contains pale green silt in which channel sands can be locally prominent features. The middle part of the Brule is the massive, flesh-colored silt typified in exposures at Scotts Bluff National Monument. The upper part is sandy and nodular, and is evident in Banner County and north of the North Platte River.

The Brule formation is an important source of local water supplies in Scotts Bluff County. Withdrawal of stock and domestic water supplies from the Brule is facilitated by a wide distribution of numerous zones of fractured material (Wenzel and others, 1946). The Brule also provides parent material for the Keota and Epping soils, and the colluvial-alluvial sediments of the Mitchell series (Yost and others, 1968). Where fractures do not occur in the Brule Formation, it is relatively impermeable and does not provide sufficient yields for other than individual domestic supplies. The distribution and size of these fractures has not been mapped, although it has been reported (Personal communication with Messrs. Andengarter and Gibbons, October, 1976) that fractures in places are large enough to allow

straw and hay particles to enter wells.

b. Arikaree Group

The Miocene age Arikaree Group in Scotts Bluff County comprises three formations. The two younger formations, the Harrison and the Monroe Creek Formations, are indistinguishable in the Scotts Bluff area. Gering is the oldest formation and is readily distinguished from the Harrison and Monroe Creek Formations.

Weathered sandstone of the Arikaree Group mixes locally with silty loess or windblown sediments to provide parent material for soils of the Creighton, Tassel, and Rosebud series. Otero, Bayard, and Bridgeport soils are formed primarily in colluvial-alluvial material first derived from weathered Arikaree sandstone (Yost and others, 1968).

Gering Formation -- The Gering Formation is a strongly laminated and locally cross-bedded fine, soft, gray sandstone. The Formation attains a maximum thickness of 200 feet southwest of Gering, and thins out toward the south and southwest, and toward the north and northwest.

The Gering Formation is permeable and will yield a significant quantity of water where a sufficient thickness of the formation is saturated. However, much of the Gering Formation in Scotts Bluff County is not saturated, and underlies rough table land south of the North Platte River. Therefore, the Gering Formation is of little hydrologic significance in Scotts Bluff County.

Monroe Creek and Harrison Formations -- The Monroe Creek and Harrison Formations are not easily distinguishable from each other in Scotts Bluff County. These formations are generally massive, brown-gray ranging upward to gray, silty to well-sorted, fine sandstone. The sandstone is highly indurated only in local zones as concretions. These concretions are distributed throughout the formations with some regularity. Seams of light

gray or white lime and limey roots and stems are abundant in the sandstones. The fine sandstone may be associated with conglomerates in some locations. The Monroe Creek and Harrison formations are situated in land areas considered undesirable for farming and irrigation.

3. Quaternary System

a. Sand and Gravel

The northern terraces and bottoms of the inner valley of the North Platte River contain highly permeable sand and gravel channel deposits derived from nearby and upstream areas of erosion. Where sufficiently thick, these deposits will yield large quantities of water (Wenzel and others, 1946).

b. Aeolian (Wind-blown) Deposits

Pleistocene aeolian deposits include loess and dune sand that occur randomly throughout the project region. Loess varies from light yellow-colored silt to yellow brown silt. Sand contents varies as a function of source, such that loess that was deposited near sands of the Arikaree Group tends to contain a higher percentage of sand-sized material than loess that occurs near the Brule or other finer grained formations. Loess generally occurs as a 4 to 5 foot thick, surficial layer on many flat areas in the study area, particularly if these areas have remained undisturbed.

Sand dunes produce a characteristic hummocky topography in parts of Scotts Bluff County. Although they are not as well developed or as extensive as in the Sand Hills area east of the study area, they nevertheless occur frequently throughout Scotts Bluff County. Dunes occur chiefly where erosion rates are minimal, thus explaining their restricted occurrence.

D. Soils

1. General

Detailed soils maps and soil capabilities have been prepared for Scotts

Bluff County (Yost and others, 1968). Similar soils information is not available for Sioux County; however, early soils maps of Sioux County (Rockie and others, 1919) have yielded information about soils at the North irrigation site.

The fundamental distribution of soils in Scotts Bluff County reflects the variability of available parent material. Residual upland soils are derived from weathered Arikaree sandstone, Brule siltstone, Chadron formations and Lance formation. Other upland soils formed in windblown silt and sand overlying these geologic formations. Terrace soils have formed in ancient alluvium, and bottom land soils have formed in recent alluvium. Foot slope soils have formed from mixed colluvial and alluvial deposits. Most surface layer soil in the county is of a loamy or coarser texture, but may be silty and clayey locally.

Poorly drained and moderately poorly drained soil covers 13 percent of Scotts Bluff County; well drained soils cover 43 percent, and excessively drained and moderately excessively drained soils cover 42 percent. Well drained soils have a medium textured subsoil, and are not affected by a high water table. Excessively drained soils have a sandy subsoil, are shallow, or are sloping to steep (Yost and others, 1968). The relative occurrence of these drainage types within the secondary study area may be somewhat different from these county statistics.

Information on soil types in the study area that may be suitable for agricultural irrigation is given in Appendix F.

A soil association map of the Primary and Secondary Study Areas is presented in Figure II-3, showing the relationships between existing wastewater treatment facilities, alternate land application sites, and soils.

2. North Site

The North Site is located entirely within Sioux County. Soil types

Figure II-3 General Soil Map of the Scottsbluff Primary and Secondary Study Areas

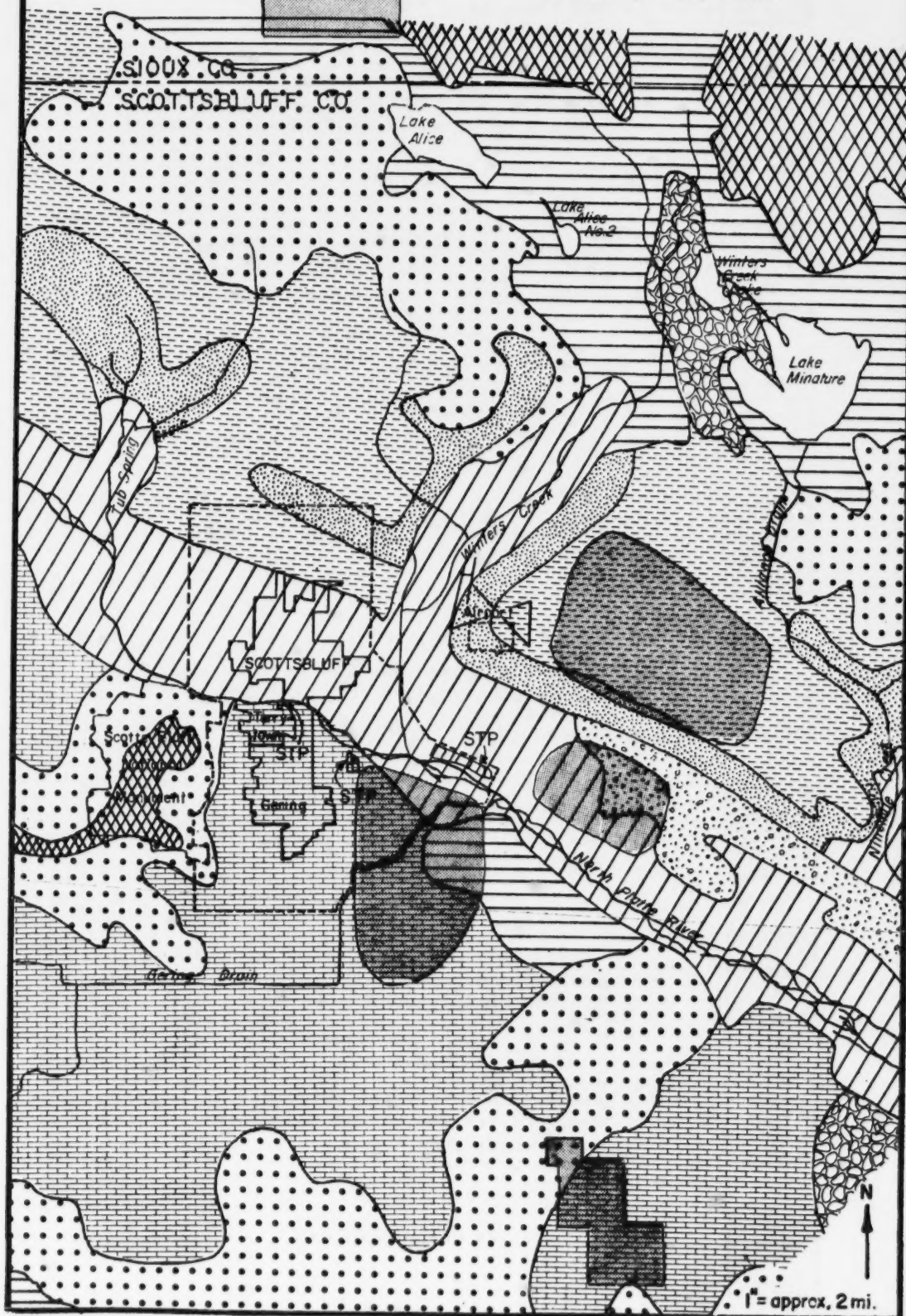
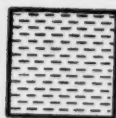
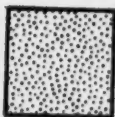


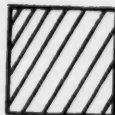
Figure II-3 (cont'd) Key to the General Soil Map of the Scotts bluff Primary and Secondary Study Areas



Tripp-Alice-Dunday association: Deep, loamy and sandy soils on high benches and terraces



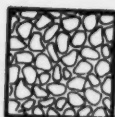
Gravelly land-Dix-Chappell association: Shallow to deep, gravelly soils on breaks of terraces



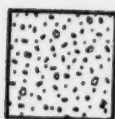
Las-Alluvial land-McCook association: Loamy, sandy, and gravelly soils on bottom lands



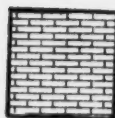
Bayard-Bridgeport association: Deep, sandy and loamy soils on foot slopes



Valentine-Dwyer association: Deep, sandy soils on uplands



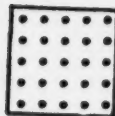
Minatare-Janise association: Strongly saline-alkali soils on bottom lands



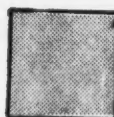
Mitchell-Otero-Buffington association: Deep, silty, sandy, and clayey soils on valley floors



Tassel-Anselmo-Rock outcrop association: Shallow and deep, sandy soils and outcrops of rock on uplands



Mitchell-Keith-Epping association: Deep and shallow, loamy and sandy soils on uplands



Alternative disposal areas

have had to be interpreted from the Sioux County soil maps by comparing adjacent areas on the more recent Scotts Bluff County. A tentative soils map for the North Site using soil type designations from the Scotts Bluff County Report is presented in Figure II-4. Relevant soils data and use limitations are presented in Table II-2.

Based upon this information, construction of storage ponds would require particular attention in sealing the pond due to moderate to rapid permeability of the lowest lying soils, "B1" (Mitchell, Otero, or Bayard). Stability of pond embankments may also be a problem if constructed from soil excavated on-site. Soils overlying and adjacent to the bluff areas (R-Tassel, Ro2-Tassel/Anselmo, and some Rol-Epping) would be unsuitable for cultivation because of steep slope or shallow depth to bedrock.

3. South Site

Soils at the South Site are illustrated in Figure II-5. Use limitations of these soils are listed in Table II-3.

The primary limitation to use of these soils is shallow depth to bedrock under Keota and Epping soils, shown as stippled areas in Figure II-5. These soils are typically less than 5 feet thick and may not provide adequate filtration of applied effluents. Storage pond construction may be hampered by shallow depth to siltstone. Particular attention would have to be given storage pond lining because of soil permeability.

4. North Valley Irrigation Area

Specific sites are not identified for use within this area. A detailed soils map is, therefore, not presented. The soils series found in this area are Tripp, Alice, and Mitchell. These are among the best agricultural soils in Scotts Bluff County. Soils data and use limitations are presented in Table II-4.

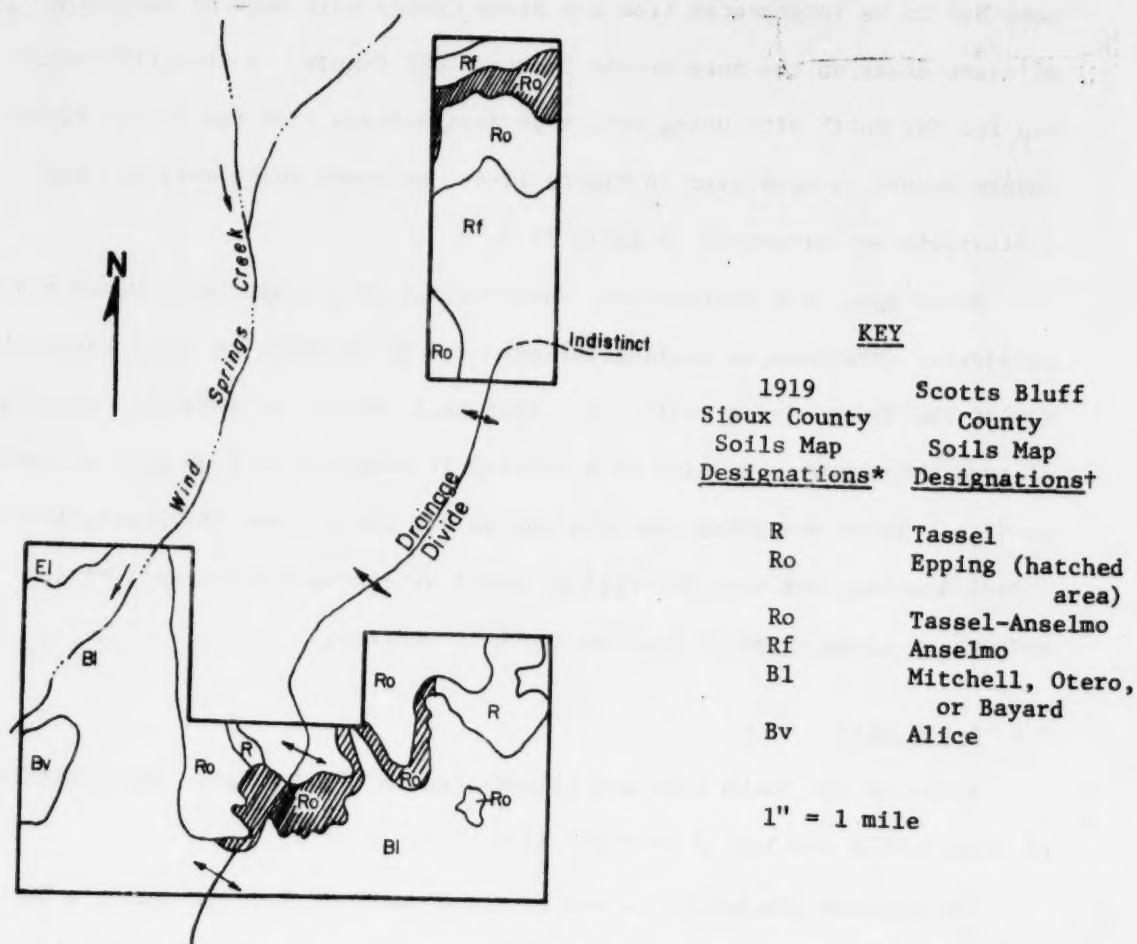


Figure II-4

Soils, Drainage Divides and Wind Springs Creek at the North Site. Wind Springs Creek is ephemeral and terminates just west of the site. Soil characteristics and use limitations are listed in Appendix D.

* Rockie and others, 1919.

† Yost and others, 1968.

Table II-2

Soil Data: North Site

	Soil Series*			
	"B ₁ "			
	Otero	Mitchell	Bayard	"B ₂ " Alice
Parent Material	Colluvial material from sandy uplands	Colluvial material from Brule siltstone	Transported material weathered from sandstone	Water-laid deposits on high stream terraces
Depth to bedrock	>5 feet	>5 feet	>5 feet	>5 feet
Surface Layer Texture	fine sandy loam	fine sandy loam to silt loam	fine sandy loam	fine sandy loam
Limiting Permeability	2.5	0.8	2.5	2.5
Available Water Capacity	.15	.16	.15	.15
pH	7.5-8.5	7.5-8.5	7.0-8.6	7.0-8.5
Reservoirs	Seepage generally not a problem	Seepage generally not a problem	Seepage not a problem	High seepage where substratum exposed
Embankments	Good if moisture control is close. Subject to piping	Good to poor stability; may need toe drains	Fair to poor stability	Fair to poor stability; piping severe; may require toe drains
Agricultural Drainage	Somewhat excessively drained	Moderate permeability; fair internal drainage; possible seepage problems	Natural drainage may be excessive	Moderate water-holding capacity. Heavy fertilization needed
Irrigation	Thin surface layer; low fertility	High water holding capacity; drainage needed in places	Moderate water-holding capacity. Heavy fertilizer needed	Moderate to severe; piping and moderate permeability
Sewage Lagoons	Severe; moderately rapid permeability	Moderate to severe; moderate permeability	Severe; rapid permeability	Soil blowing
Management Problems	Soil blowing and low natural fertility. Water erosion on steep (3-12%) slopes	Soil blowing and water erosion	Soil blowing. Water erosion on steep (3-20%) slopes	

* Soil Series were identified by interpretation of the 1919 Sioux County Soils map (USDA, 1919) and comparison to soil series designations for Scotts Bluff County (Yost, et al., 1968).

Table II-2- Cont'd.

	Soil Series			
	"A" Tassel	"B ₁ " Epping	"B ₂ " Tassel-Anselmo Complex	"B ₃ " Anselmo
Parent Material	Weathered limy sandstone	Brule siltstone	Weathered limy sandstone and wind deposited materials	Wind deposited materials in uplands
Depth to bedrock	At or near surface	10"-20"	0' to > 3'	> 5 feet
Surface Layer Texture	fine sandy loam	silt loam	fine sandy loam	fine sandy loam
Limiting Permeability	0.8	0.8		2.5
Available Water Capacity	.16	.16		.10
pH	7.5-8.5	7.5-8.5		7.0-8.5
Reservoirs	Seepage not a problem	Seepage not a problem except where siltstone if fracturing		Moderate to high seepage
Embankments	Good stability above sandstone.	Fair to poor stability		Fair to poor stability; piping may be severe; may require toe drains
Agricultural Drainage	Excessively drained			
Irrigation		Low water-holding capacity. High erodibility on steep slopes		Moderate water-holding capacity. High erodibility
Sewage Lagoons	Severe: shallow to sandstone	Severe:		Moderate to severe; moderately rapid permeability
Management Problems	Not suitable to cultivate	Soil blowing and wind erosion	Not suited to cultivation	Soil blowing and water erosion



Figure II-5

Soils of the South Site. Soil characteristic and use limitations are listed in Table II-3.

Table II-3

Soil Data: South Site

	Soil Series				
	<u>Mitchell Soils</u>	<u>Keota Soils</u>	<u>Bridgeport Soil</u>	<u>Otero-Bayard Soil</u>	<u>Epping Soil</u>
Parent Material	Colluvial material derived from Brule siltstone	Brule siltstone	Colluvium below bluffs	Sandy Colluvial material transported from the sandy uplands	Brule siltstone
Depth to bedrock	>5 feet	20" - 40"	>5 feet	>5 feet	10" - 20"
Surface Layer Texture	silt loam	silt loam	very fine sandy loam	fine sandy loam	silt loam
Limiting Permeability	0.8	0.8	0.8	2.5	0.8
Available Water Capacity	.16	.16	.16	.15	.16
pH	7.5-8.5	7.5-8.8	7.2-8.5	7.5-8.5	7.5-8.5
Reservoirs	Seepage generally not a problem	Seepage not a problem	Seepage is minor problem		Seepage not a problem except where Brule siltstone is fractured
Embankments	Good to poor stability; may need for drains	Good to poor stability	Fair to poor stability		Fair to poor stability
Agricultural Drainage	Fair internal drainage; possible seepage problems	Good internal drainage; over irrigation may cause seeps; 1 1/2 ft. to siltstone			
Irrigation	Holding capacity; drainage needed in places	Moderate water-holding capacity; shallow root zone	Moderate to high water holding capacity		Low water holding capacity; shallow root zone; high erodibility on steep slopes
Sewage Lagoons	Moderate to severe Moderate permeability	Severe; siltstone near surface	Moderate to severe moderately slow permeability		Severe" Shallow to siltstone
Management Problems	Soil blowing and water erosion	Soil blowing and water erosion	Soil blowing and water erosion	Soil blowing	Soil blowing and water erosion

Table II-4

Soil Data: Valley Site - Irrigation North of the Platte River

	Soil Series		
	Tripp	Alice	Mitchell
Parent Material	Terrace alluvium over sand and gravel deposits	Terrace alluvium usually overlying sand and gravel deposits	Colluvial material derived from Brule siltstone
Depth to bedrock	5 feet + to sand and gravel. 5 feet to bedrock	5 feet + to sand and gravel. 5 feet to bedrock	>5 feet
Surface Layer Texture	Very fine sandy loam	Fine sandy loam	Silt loam
Limiting Permeability	0.8	2.5	0.8
Available Water Capacity	.16	.15	.16
pH	7.0-8.5	7.0-8.5	7.5-8.5
Reservoirs	Moderate to high seepage, depending on depth of excavation	High seepage where substratum exposed	Seepage generally not a problem
Embankments	Good to poor stability; may require toe drains	Fair to poor stability; piping severe; may require toe drains	Good to poor stability; may need toe drains
Agricultural Drainage	Generally good		Moderate permeability; fair internal drainage; possible seepage problems
Irrigation	High water holding capacity	Moderate water holding capacity; heavy fertilization needed.	High water holding capacity; drainage needed in places.
Sewage Lagoons	Moderate to severe Moderate permeability	Moderate to severe; piping and moderate permeability	Moderate to severe; moderate permeability
Management Problems	Soil blowing	Soil blowing	Soil blowing and water erosion

The Tripp and Alice soils are underlain by sand and gravel deposits which might be too permeable to provide adequate filtration of applied effluents. Soil boring would have to be performed in any site selected for agricultural irrigation to assure at least five feet of fine soil material. The sand and gravel deposits, if encountered in storage pond construction, would require extraordinary measures to seal the pond bottom. Proper control of pond liner permeability would be necessary in any of these soils because of soil permeability. Stability of these soils in pond embankments could also be a problem and would necessitate close control and possibly import of more compactable soil material.

5. South Valley Irrigation Area

Specific sites are not identified for use within this area. A detailed soils map is, therefore, not presented. Soil series found in this area are the same as those in the South Site. Soils data and use limitations would be the same as those listed in Table II-3 for the South Site.

6. Valley Complete Retention Area

Specific sites are not identified for use within this area. A detailed soils map is, therefore, not presented. Soils series found in this area are Janise, Las, and Minatare. All of these soils have high groundwater tables. Due to capillary rise of water from the water table, these soils are moist from the water table to the surface much of the year. As a result, evapotranspiration causes dissolved salts to accumulate in these soils and they are typically too saline and alkaline for cultivation.

These soils are underlain at depths of 2 to 6 feet by sand and gravel deposits. Extraordinary measures may be necessary to drain these soils for pond construction and to seal pond bottoms because of the permeability of

the saturated sand and gravel deposits.

Soils data and use limitations are listed for these soils in Table II-5.

E. GROUNDWATER QUALITY AND HYDROLOGY

1. Groundwater Distribution

Significant groundwater aquifers in Scotts Bluff County include the Lance and Brule formations, and the Pleistocene sand and gravel deposits of the North Platte River Valley.

a. Lance Formation

The Lance formation appears at the surface of Scotts Bluff County in a few isolated localities near the Wyoming border. Elsewhere in the county, this clay and sandstone Formation is either absent or overlain by younger Tertiary sediments. When tapped by wells, sandstone beds of the Lance formation will yield a flow of about one gallon per minute of artesian water in a steady, year round flow. This amount of water has been sufficient to satisfy local stock and domestic needs. The Lance formation is rarely entered by wells in the study area.

b. Brule Formation

Although the Brule formation is the most extensive aquifer in Scotts Bluff County, it is much less productive than the Pleistocene sand and gravel deposits. Wells in this formation yield considerably less than 500 gallons of water per minute. The Formation is composed of impermeable fine-grained sands and silt, but generally is permeable because fracture zones occur locally in the Formation. Wells that penetrate non-fractured portions of the Brule generally fail to produce significant amounts of water (Wenzel and others, 1946). The City of Gering's water supply consists of wells drilled into the Brule formation. The moderate yields of these wells have

Table II-5

Soil Data: Valley Site - Complete Retention

Parent Material	Soil Series		
	Janise	Las, Alkali	Minatare
	Alluvium or silty material from weathered siltstone	Medium-textured alluvium	North Platte River alluvium
Limiting Permeability (in/hour)	0.2	0.8	0.05
Maximum Permeability of subsoil (in/hour)	2.5	10	0.8
Reservoirs	Seepage is a problem	Seepage not a problem except where substratum is exposed	Seepage may be a problem where substratum is exposed
Embankments	Good to poor stability	Good to poor stability	Good to poor stability depending on density; high compressibility
Sewage Lagoons	Moderate: moderate to moderately slow permeability	Moderate to severe: moderate permeability	Moderate: cost of sealing sandy and gravelly material is high

been the source of past water supply problems during peak demand periods.

c. Sand and Gravel Deposits

The Pleistocene and Recent sand and gravel deposits are situated beneath bottom lands along the North Platte River, and beneath terraces north of the river. Sand and gravel deposits up to 200 feet thick occur as fill in ancient channels cut in the Brule formation by the North Platte River and its tributaries. Wells dug into these channel deposits generally yield more than 1,000 gallons per minute. The location of this important aquifer within the study area is shown in Figure II-6. The City of Scottsbluff is situated on the sand and gravel beds and draws its water supply from them with a series of high-yield wells.

Sand and gravel deposits less than 20 feet thick underly terraces and benches north of the river up to the bluff areas. Wells in these deposits yield only small amounts of water. There are no significant sand and gravel deposits south of the North Platte River (Wenzel and others, 1946).

2. Groundwater Recharge and Movement

Seepage of irrigation water, precipitation, and underground flow of water (underflow) are the primary aquifer recharge mechanisms for the Brule formation. Frequency and amount of recharge are dependent upon local precipitation and distribution and amount of surface water diversions for irrigation. Recharge rates in many upland areas appear to be very high as evidenced by the frequent occurrence along the borders of the valley of steep gulleys which terminate without visible surface outlets on gentler slopes.

Recharge of the sand and gravel deposits is primarily by the North Platte River and its tributaries where they cross the deposits. The direct hydrologic connection between the river and the groundwater in the deposits is evidenced by rapid response of groundwater elevations in the deposits to

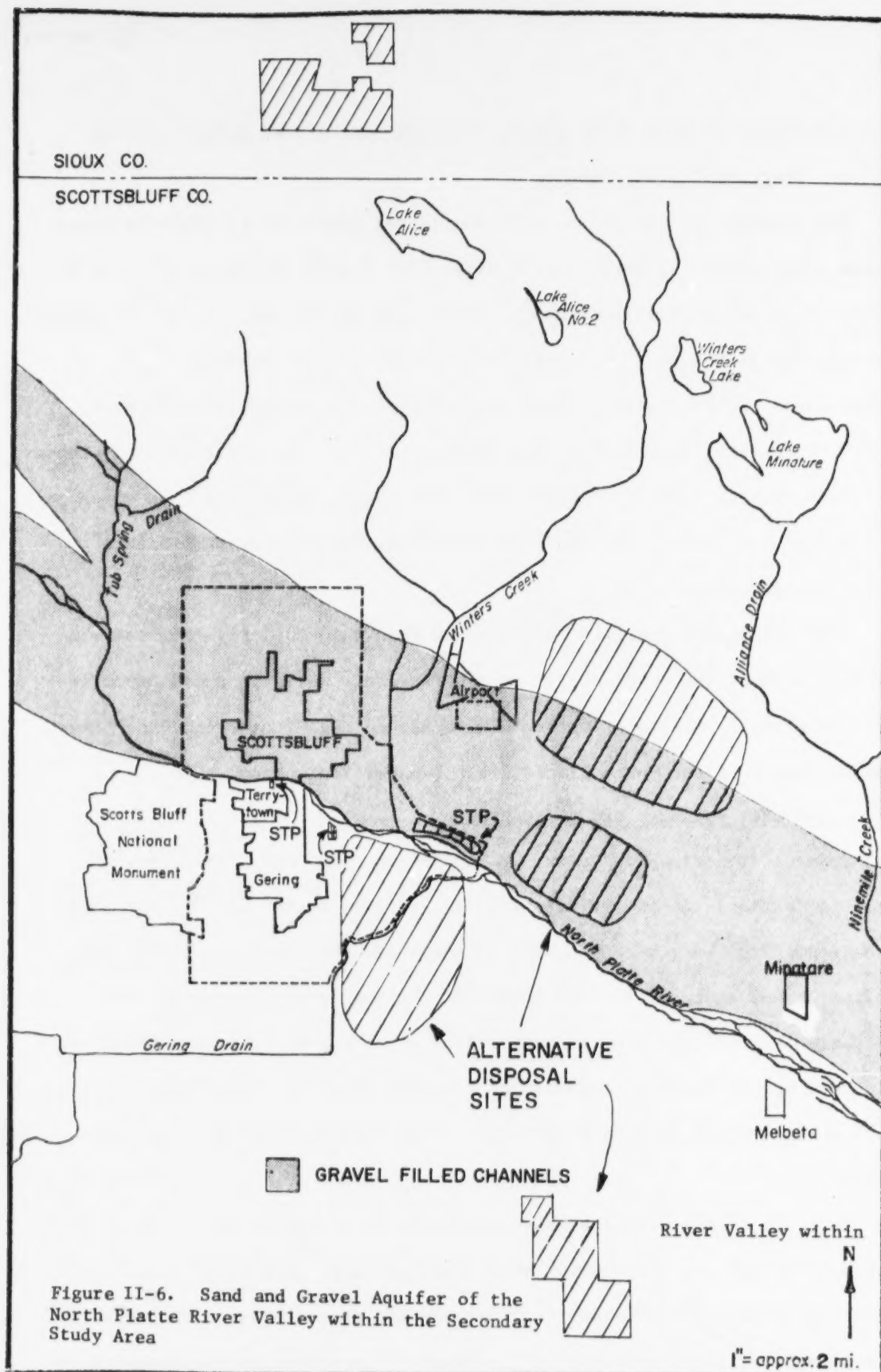


Figure II-6. Sand and Gravel Aquifer of the North Platte River Valley within the Secondary Study Area

river stage.

Groundwater underflow outside of the sand and gravel deposits is influenced locally by topography, but generally is in a direction perpendicular to the North Platte River. The water table follows the land surface with depth below land surface generally not exceeding 100 feet except in the bluff areas. Seepage from the unlined irrigation canals, laterals, and ditches, and from irrigated fields, has raised the groundwater table above natural levels. It has been estimated that "in places the water table now probably stands from 10 feet to perhaps 50 or 100 feet above its stage before irrigation was begun." (Wenzel and others, 1946) Rate of groundwater movement beneath the upland areas has not been estimated. Groundwater feeds numerous wells, springs, and streams in the upland areas. Sizable springs which occur at the contact between the Brule formation and overlying sand and gravel terrace deposits create excellent trout spawning beds north of the North Platte River.

Groundwater underflow beneath the North Platte River follows an hydraulic gradient of 7 feet to the mile and was calculated by Wenzel and others (1946) to flow at a velocity of one foot per day.

3. Groundwater Quality

Quality of groundwater is measured by physical, chemical, and biological characteristics of well water samples as determined by laboratory analysis. Although groundwater quality in Scotts Bluff and southern Sioux Counties is generally acceptable, uncontrolled surface discharge from rural domestic septic tanks (Personal Communications with Messrs. Schlife and Taylor, Scotts Bluff County Health Department, October, 1976) could introduce local groundwater pollution in the future. The extent and seriousness of this problem has not been determined because of an absence of factual information concerning locations and volumes of flows from these tanks.

a. Physical Characteristics

Physical characteristics of groundwater include total solids content, color, odor, and temperature. Solids include floating, suspended, colloidal, and dissolved matter. The only reported case of deleterious suspended solids within the study area is the occasional contamination of Sioux County wells with hay and straw (Personal communication, Messrs. Andengarter and Gibbons, October, 1976). Groundwater temperature in Scotts Bluff County ranges from 50° to 53°F (Yost and others, 1968). There are no known reports of serious color or odor deficiencies in local groundwater supplies.

b. Chemical Quality

Both significant aquifers in the study area, the sand and gravel deposits and the Brule formation, yield water of moderate hardness and moderate concentrations of nitrates.

The most recent available chemical data on groundwater from the sand and gravel deposits are analytical results from sampling of ten Scottsbluff wells. (Personal communication with Mr. Tim St. Onge, April, 1977). Average concentrations of relevant constituents are:

Sodium	-	63 mg/l
Calcium	-	105 mg/
Iron	-	0
Manganese	-	0
Total Hardness	-	347 mg/l
Total Alkalinity	-	284 mg/l
Fluoride	-	.43 mg/l
Chloride	-	23 mg/l
Sulfate (as SO ₄)	-	234 mg/l
Nitrate (as N)	-	4.6 mg/l

Total Dissolved Solids - 708 mg/l

pH - 8.2

Nitrate concentrations were well within the EPA drinking water standard of 10 mg/l as N. Sulfate concentrations approach the recommended maximum concentrations for drinking water supplied (National Academy of Sciences - National Academy of Engineering, 1972). Because of the hardness of these groundwaters, a large but unquantified percentage of domestic, commercial and industrial water users in the study area soften the water on-site with ion exchange resin softening units. None of the local municipalities provide centralized water softening units. Brine used to recharge on-site softening units is thought to be a significant source of dissolved solids in wastewater locally.

The chemical character of groundwater taken from the Brule formation is similar to that from the sand and gravel deposits except that the Brule groundwater is not as highly mineralized and, in some areas, is softer (Wentzel and others, 1946). Insufficient nitrate concentrations data for the Brule formation is available to provide an expected average.

Spalding (1975) found that nitrate concentrations beneath the bottom land of the Platte River in Hall County were diluted by input from the river. Nitrogen sources on the bottomland plus high nitrate concentrations in groundwater flowing in from the terraces resulted in a five-fold increase in nitrate concentrations from near the river to the northern limit of the bottom land. Groundwater nitrate concentrations in the terraces and uplands were even more variable with particularly high levels in the vicinity of feedlots and intensely fertilized and cultivated, sandy soils. Similar patterns might be expected in the bottomlands, terraces and uplands of the Scotts Bluff County study area.

Groundwater from the Lance formation is very soft with relatively high sodium concentrations, very high bicarbonate concentrations, low sulfate concentrations and low chloride concentrations. This groundwater is not known to be used within the study area, although two abandoned wells in Scottsbluff and Gering are reported to tap it. (Wenzel et al., 1946)

Bacterial Quality -- Reports of wells in the Brule formation becoming contaminated with vegetation debris imply the likelihood of concurrent bacterial contamination. However, insufficient analysis is provided of whether the contamination resulted from poor well construction or from general susceptibility of the aquifer to unfiltered recharge.

F. SURFACE WATER

Significant surface water resources in the study area include the North Platte River, its local tributaries, and irrigation canals and irrigation storage reservoirs. All of the small streams in the study area are tributary to the North Platte. The North Platte is the main input to McConaughy Reservoir, which sustains the only reservoir-based population of rainbow trout on the Great Plains.

1. Surface Water Hydrology

The hydrology of these surface water resources has been significantly altered from natural conditions by water withdrawal and return for agricultural irrigation. It has been estimated that approximately 3.3 acre-feet of surface water are diverted per acre of irrigated land in the North Platte River valley (Nebraska Natural Resources Commission, 1975). As consumptive water use by locally important crops accounts for only 1.4 to 2.6 acre-feet per acre per year (USDA, 1972), apparently substantial irrigation water is lost to groundwater, surface water bodies, and evaporation. The impact on

stream flows is evident by comparing .01-.04 cfs/mi², the average annual runoff per square mile for the North Platte River, to .28-1.0 cfs/mi², the average annual runoff for local tributaries draining irrigated areas (Nebraska Natural Resources Commission, 1975). Since modern stream flow monitoring was implemented long after extensive irrigation in the valley, natural stream flow characteristics are not quantified. Recent stream flow characteristics of gauging stations in and near the study are tabulated in Table II-6.

Well developed drainage patterns are evident in most parts of the study area. Natural drainage patterns, however, have been altered by irrigation canals, drains and stream channelization. Drainage is imperfect in nearly level areas bordering the Platte River and on the low river terraces east of Scottsbluff. In the bluff areas on either side of the valley, intermittent streams have formed canyons and gulleys that terminate on alluvial fans without joining permanent streams. Some small drainage basins below the bluffs have no visible surface outlets.

The locations of major irrigation canals and districts are shown in Figure II-7 along with identified irrigation return flow points. Two reservoirs in the northeast part of the study area, Lake Alice and Lake Minatare, provide storage and control of irrigation water flows in the Interstate Canal System. All canals are unlined and contain water only during the irrigation season. Irrigation return flows occur primarily from June through September.

2. Surface Water Quality

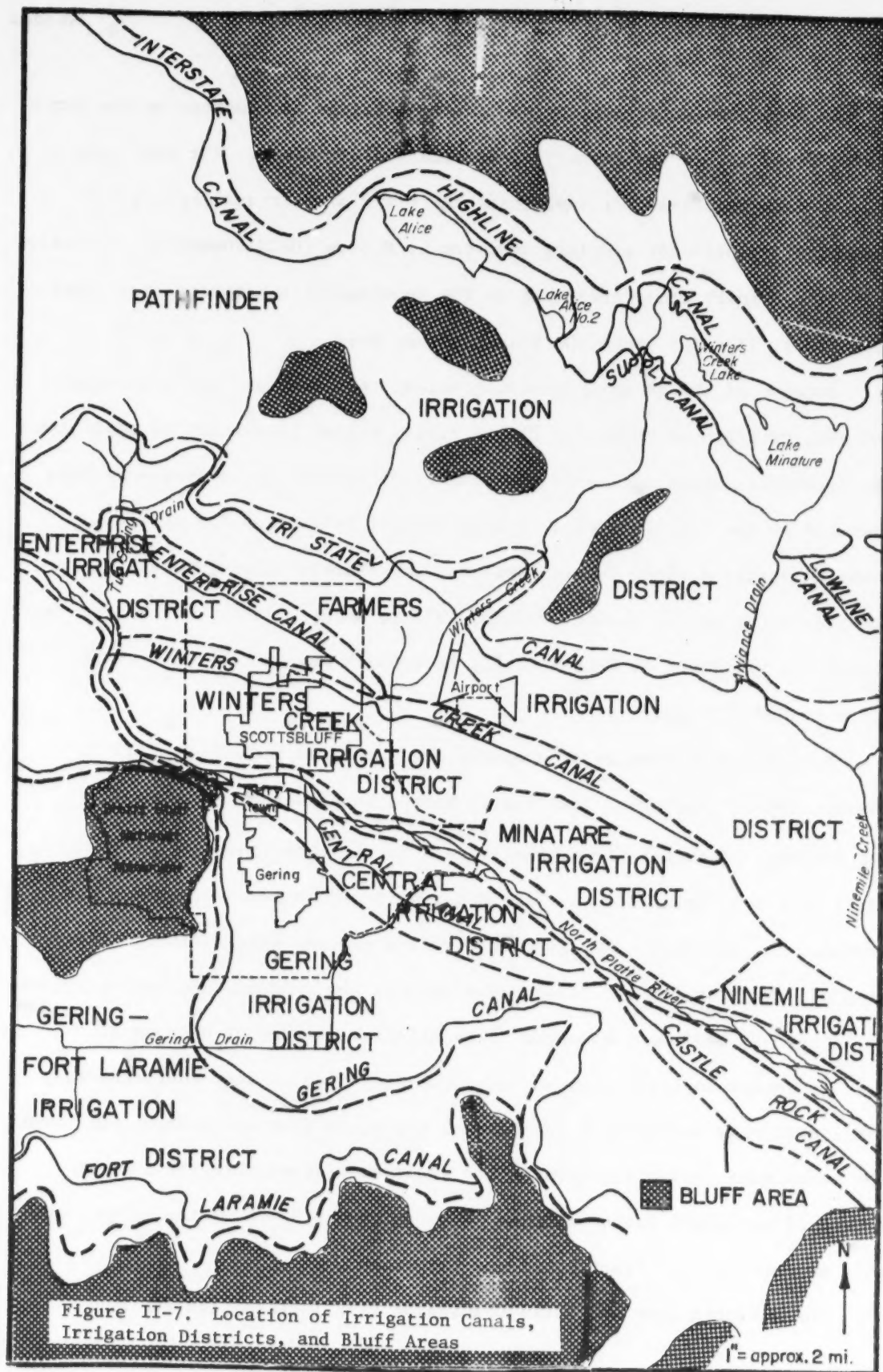
a. North Platte River

Table II-6. STREAMFLOW CHARACTERISTICS AT GAGING STATIONS NEAR SCOTTSBLUFF, NEBRASKA IN THE NORTH PLATTE RIVER BASIN.

Above Secondary Study Area			Within Secondary Study Area				Below Secondary Study Area	
North Platte River at Wyoming-Nebraska State Line (6745)			North Platte River at Mitchell (6795)		Tub Springs near Scottsbluff (6800)		North Platte River near Minatare (6820)	
Dry Spotted Tail Creek at Mitchell (6790)							Gering Drain near Gering (6815)	
Winters Creek near Scottsbluff (6810)								
Mean Discharge								
Year								
Period of Record								
26,177								
77.2								
1941-1973								
Mean Discharge								
Year								
October								
November								
December								
January								
February								
March								
April								
May								
June								
July								
August								
September								
Minimum 7-Day Discharge								
2-year								
10-year								
25-year								
Extremes in daily discharges								
Maximum								
Date								
Minimum								
Date								
Average Annual Unit Runoff per Sq. Mi.								
0.03								
0.42								
0.02								
0.28								
0.51								
0.50								
1.0								

1/ Obtained through application of Log Pearson III distribution.
 2/ 7-day, 10 year low flows are those applicable for use with Nebraska water quality standards.
 3/ Peak flow caused by break in Interstate Canal.

SOURCES: North Platte River Basin Water Quality Management Plan, June 1975.
 U. S. Geological Survey Water Data Report NE-75-1



No long-term water quality monitoring stations are located on the North Platte River within the Primary or Secondary Study Areas. The most comprehensive data available for describing the river's water quality are U.S. Geological records for sampling stations at McGrew (USGS #06682505), 12 miles below the Primary Study Area, and at the Wyoming-Nebraska state line (USGS #06674500), 23 miles above the Primary Study Area.

Because of the steep hydraulic gradient (6.5 feet per mile, average) and shallow depth of the North Platte River, stream reaeration is rapid and the dissolved oxygen regime is excellent. Dissolved oxygen concentrations measured by the U.S. Geological Survey did not fall below 7.0 mg/l at sampling stations above (state line) and immediately below (McGrew) the study area during the period of June, 1973 to August, 1976. The BOD concentration in the river at McGrew rarely exceeded 5 mg/l during that period and averaged 2.9 mg/l.

A statistical summary of sampling data acquired from June, 1973 to August, 1976 at the state line and at McGrew is presented in Table II-7. The average values for these constituents on the three lowest-flow sampling dates were also calculated but are not reported here because, except for ammonia, the low flow average concentration was not significantly different from the averages for all flows. The ammonia low flow average concentrations at McGrew was 0.02 mg/l compared to an all-flow average of 0.11 mg/l.

Increases in total phosphorus, total dissolved solids, conductance, fecal coliforms and boron occur between the state line and McGrew. Although the three municipal discharges in the study area constitute the largest source of municipal wastes in this stretch of the North Platte, they could only account for a fraction of the increases.

The Nebraska Game and Parks Commission (1972) classifies the North

Table II-7

Statistical Summary of North Platte River Water Quality
Data: June, 1973 to August 1976

	State Line (USGS #06674500)			McGrew (USGS #06682505)		
	<u>Min.</u>	<u>Mean</u>	<u>Max.</u>	<u>Min</u>	<u>Mean</u>	<u>Max</u>
Total N as N (mg/l)		N/A		1.3	3.15 n=31	5.0
NH ₃ as N (mg/l)		N/A		0.0	0.11 n=38	0.37
NO ₂ +NO ₃ as N (mg/l)		N/A		0.67	2.17 n=32	3.6
Total P as P (mg/l)	0.0	0.10 n=35	0.30	0.08	0.46 n=38	4.4
SO ₄ ⁼ (mg/l)	140	198 n=46	240	160	203 n=14	220
Boron (µg/l)	70	96 n=10	140	110	156 n=14	210
Zinc (µg/l)		N/A		70	145 n=6	230
TDS (mg/l)	428	517 n=10	684	482	612 n=24	681
Conductance (µmho/cm)	502	781 n=43	1040	705	898 n=39	1020
	<u>geometric mean</u>			<u>geometric mean</u>		
Fecal Coliforms (#/100 ml)	2	80 n=44	21,000	17	422	>6000

Source: U.S. Geologic Survey computer printout of Water Quality Data
processed October 26, 1976.

Note: N/A = not available
n = number of samples.

Platte River in the study areas as "degraded". Their definition of "degraded" is: "Waters of potentially higher class but presently little used because of water withdrawal or pollution." The classification is meant to describe the importance of the water body to anglers and does not identify the particular water quality, aesthetic, productivity or accessibility problems which result in low fishing pressure. The Commission does amplify on the water quality problem of sedimentation:

"...nearly all streams in the state are severely degraded by sedimentation, resulting primarily from improper land use or treatment...There is good reason to believe that if sedimentation in the North Platte River and tributary streams above McConaughy Reservoir could be controlled, the resulting improvement in the rainbow trout fishery would result in nationwide use and a Class 1 rating."

Highly erodible soils, intense agriculture, and sand and gravel mining operations in the riverbed contribute to the sedimentation problem.

b. Tributary Streams

All of the major tributary streams in the study area receive irrigation return flows from June through September. Irrigation water passing through and over the ground gains and loses constituents as listed in Table II-8. The Nebraska Natural Resources Commission (1975) collected and analyzed water samples from three local tributaries during the 1968 irrigation season. Average concentrations and flows for the three tributaries are shown in Table II-9. Concentrations of TDS and nitrates during that period are within the range of values for these parameters monitored in the North Platte River by USGS at McGrew during the July to October periods of 1973 to 1976.

Only the streams on the north side of the North Platte have sustained flows of adequate temperature and quality to support rainbow trout smolts through the summer. Groundwater stored in the terrace deposits and supplemented by irrigation probably provides the base flow for these trout streams.

Table II-8

Water Quality Changes in Irrigation Return Water

	<u>Surface Runoff</u>	<u>Drainage Water</u>
Total Dissolved Solids	Slight increase	Considerable increase
Pesticides	Variable increase	
Fertilizer	Variable increases in nitrogen and phosphorus compounds	Phosphorus removed by soil; nitrogen increase as nitrate
Sediments and Colloidal Material	Increase	Little or none remaining after percolation
Bacterial Content	Increase	General reduction of pathogenic organizing and coliform bacteria.

Table II-9

Water Quality of Streams During 1968 Irrigation Season

	<u>Flow (cfs)</u>	<u>Specific Conductivity (μmho/cm)</u>	<u>TDS (mg/l)</u>	<u>NO₃ (mg/l)</u>	<u>Cl (mg/l)</u>	<u>Na (mg/l)</u>
Winters Creek	88.5	796	553	1.7	24	105
Gering Drain	95	881	619	2.3	33	173
Scottsbluff Drain	5.2	1040	710	1.8	30	147

Source: Nebraska Natural Resources Commission, 1975.



The quality of these streams for trout reproduction has been linked closely with stream bank protection and land management and not with local pollution sources such as irrigation return flows and feedlot runoff (Velson, No Date).

c. Lake McConaughy

This man-made reservoir is well below the study area, but is an important link in the life cycle of the rainbow trout that spawn in tributaries within the study area. Reduction of cold water habitat during the summer is the result of natural temperature stratification and deoxygenation of the bottom waters. Eutrophication of the lake by nutrient and sediment accumulation will gradually reduce the summertime cold water habitat and thereby limit the size of the sustainable trout population. The present sediment, phosphorus, and nitrogen loads from all sources monitored at the McGrew station average 5.3×10^6 lbs suspended solids/day, 3.2×10^3 lbs -P/day, and 2.0×10^4 lbs - N/day. The rate of lake eutrophication cannot be predicted with these figures, but they serve as a baseline against which to compare suspended solids and nutrient load input or removals attributable to the wastewater management alternatives considered here.

G. FLOOD HAZARDS

The North Platte River Valley has been mapped for potential flooding limits most recently by the U.S. Army Corps of Engineers (COE), superseding earlier mapping by the U.S. Geological Survey. Two flooding limits are identified by the COE. The Intermediate Regional Flood, commonly referred to as the 100-year flood, is shown in Figure II-8. The Standard Project Flood, considered to be the worst case condition, is shown in Figure II-8. Of the two, the limits of the 100-year flood are normally the extent considered to be practical in planning for flood protection.

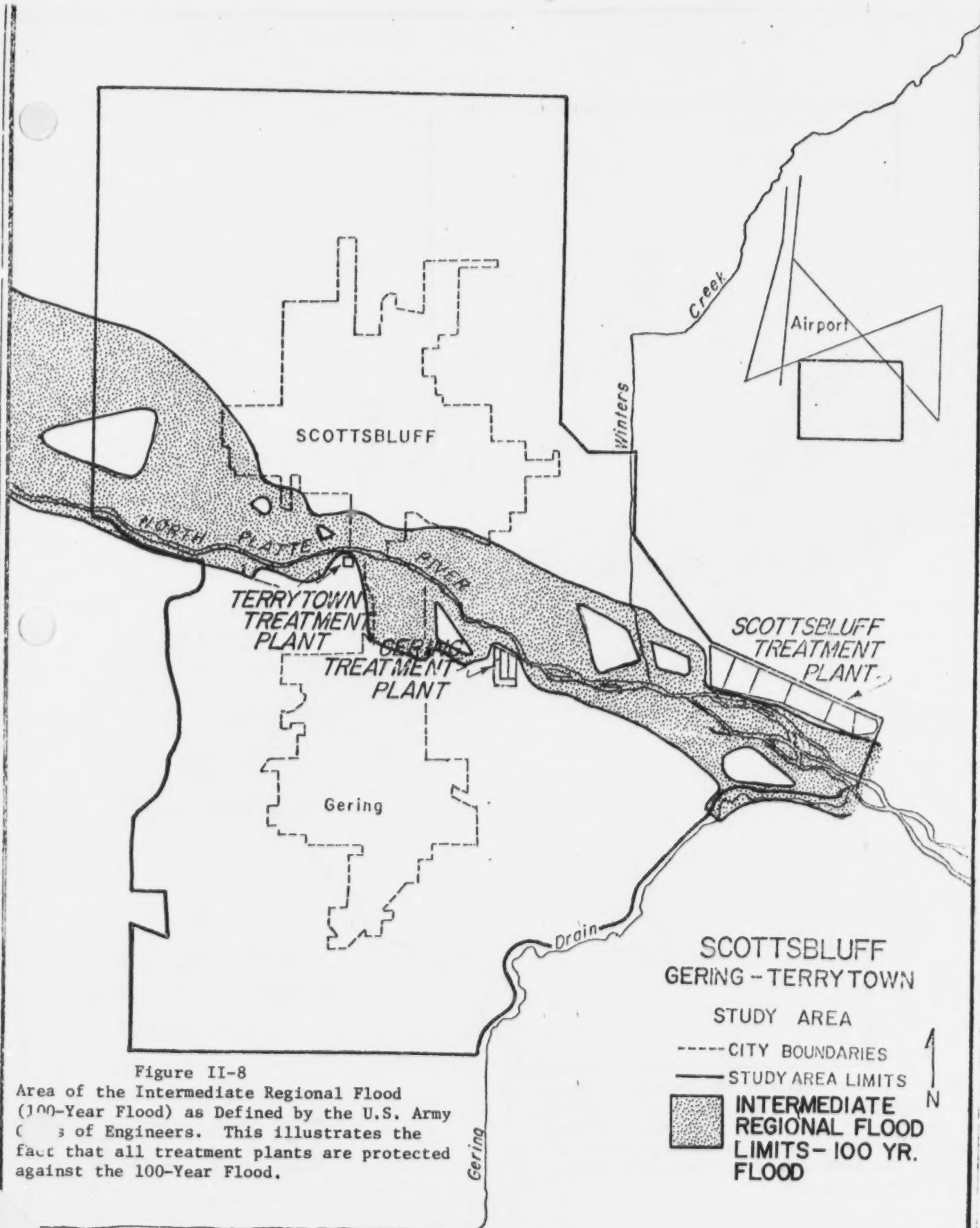
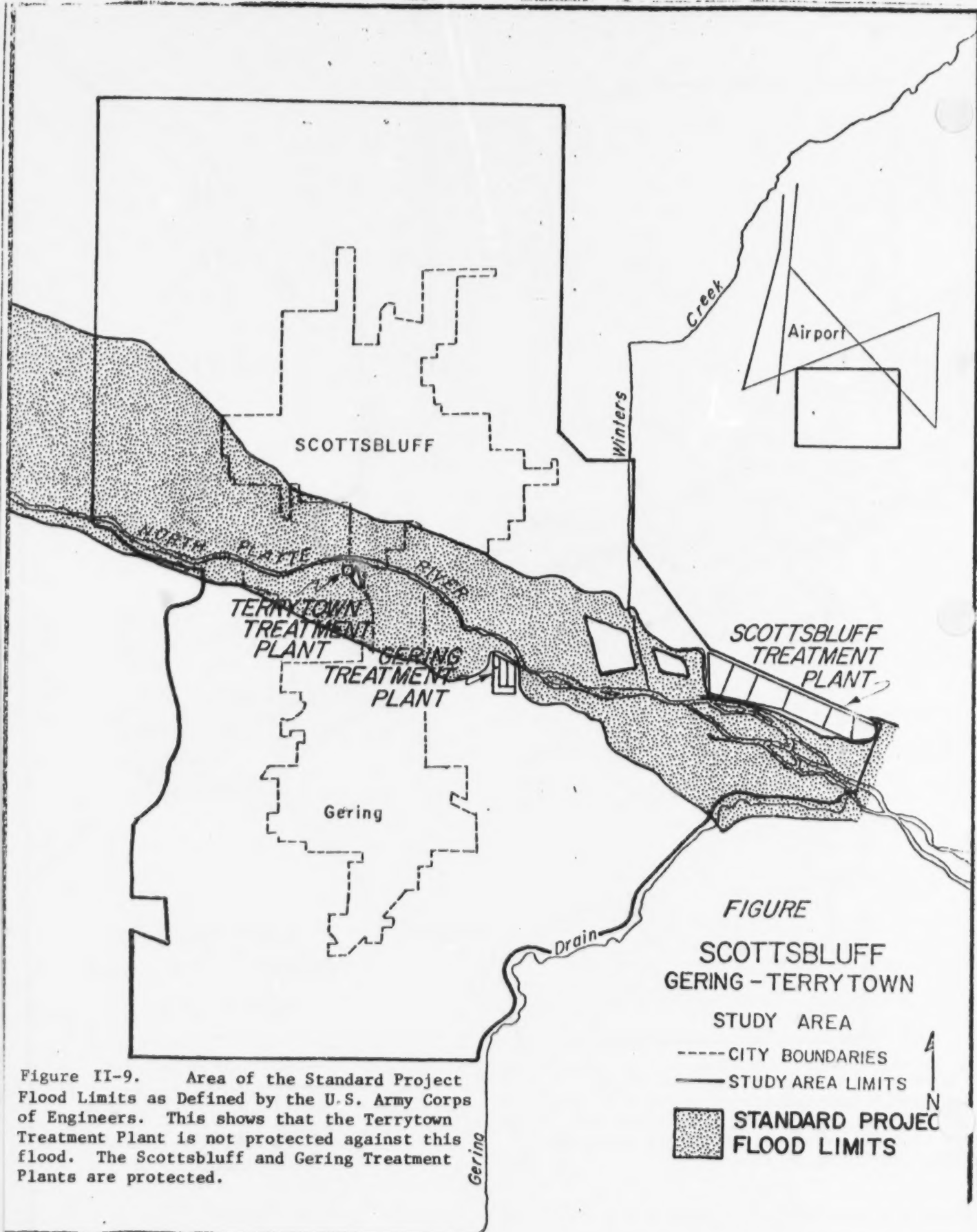


Figure II-8

Area of the Intermediate Regional Flood (100-Year Flood) as Defined by the U.S. Army Corps of Engineers. This illustrates the fact that all treatment plants are protected against the 100-Year Flood.



All of the area's municipal treatment plants are located in the floodplain of the North Platte River. The Scottsbluff and Gering lagoons are protected from flooding by dikes surrounding the facilities. Terrytown's treatment plant, as is most of the village of Terrytown, is protected from the 100-year flood by dikes. A number of gravel pits and industrial waste lagoons are also located in the floodplain and are protected by dikes.

The dikes which protect these areas from flooding actually increase the flood hazard somewhat by reducing the cross-sectional area of the river channel at flood flows and causing floodwaters to back up behind the restriction. Also, increased water velocities just downstream of the channel restrictions can increase the potential for erosion.

Regulation of construction activities in flood plains is provided by local, state and federal agencies. The Nebraska Flood Plain Regulations Act is enforced within the Primary Study Area by the City of Scottsbluff within its limits of jurisdiction and by the Commission in all other areas. In brief summary, the Act requires that construction of objects within the 100-year floodplain are subject to the permitting authority of the Commission, or in this case, the City of Scottsbluff. Specifically permitted uses include ". . . public utility wire and pipelines for transmission and local distribution." The Act does not apply to structures installed prior to October 23, 1967, except that reconstruction of any such significantly damaged structures would require a permit. Several of the alternatives considered here (Chapter III) could require the siting of small wastewater or sludge treatment facilities at the edges of the designated 100-year floodplain. The requirements of the Nebraska Flood Plain Regulations Act would have to be met to implement those alternatives.

Recent initiatives in floodplain management by the federal government

have been guided by Executive Order 11988 of May 24, 1977 (Federal Register, Vol. 42, No. 101, Wednesday, May 25, 1977). Application of this Executive Order to the EPA Construction Grants Program is expected to require detailed evaluation of alternatives sited out of the floodplain when the proposed action is in a floodplain. Application of the Executive Order to the upgrading of existing treatment facilities which encroach on floodplains, as do the Scottsbluff and Gering lagoons, is unclear as yet. Implementation of any alternative using the existing facilities would require clarification of policy toward existing facilities. Implementation of those alternatives which include construction of new treatment units in the floodplain, in particular those considered in upgrading the Scottsbluff lagoon system, would require more detailed evaluation of alternative sites out of the floodplain.

H. WATER USES

1. Surface Water

Surface water in the North Platte River Basin is used primarily for irrigation. Livestock watering, local groundwater recharge, recreation and assimilation of wastes are other important uses of surface water.

a. Irrigation - The waters of the North Platte River have been diverted for irrigation purposes for nearly a century. Many private irrigators and several irrigation districts utilize the waters of the North Platte and its tributaries for irrigation purposes. Water is provided for the North Platte Project (which extends into Nebraska) by the Pathfinder and Guernsey Reservoirs in Wyoming. Water is supplied to the Pathfinder Irrigation District on the north side of the North Platte River through the Interstate Canal and to the Gering-Fort Laramie Irrigation District on the south side of the river through

the Gering-Fort Laramie Canal. Two reservoirs, Lake Alice and Lake Minatare, regulate the water supply along the Interstate Canal.

Approximately 1.2 million acre-feet of surface water are diverted annually to irrigate 365,000 acres in the North Platte River Basin of Wyoming and Nebraska. Return flows make up a significant portion of the total amount diverted, and may be used several times for irrigation purposes as they move downstream.

b. Other Uses - Small amounts of surface water are stored in farm ponds for recreation, fish and wildlife, and livestock water supplies. No communities in the secondary study area use surface water for municipal supplies.

The North Platte River and its tributaries support high quality warm and cold water fisheries that attract many fishermen. The largest body of water in the state for recreation and fishing activities is Lake McConaughy.

The current annual stream fishing use in the entire North Platte Basin is estimated to be approximately 40,000 fishing occasions. The use of standing waters such as Lake McConaughy is approximately 300,000 fishing occasions per year.

2. Groundwater

a. Irrigation

The abundant groundwater sources are used extensively for irrigation. The use of groundwater for irrigation is expected to increase because most of the irrigable land with economically available surface water has already been developed. In 1985 an estimated 75.1 million gallons of groundwater will be used for irrigation purposes in the North Platte River Basin. (North Platte River Basin Water Quality Management Plan, 1975)

b. Municipal

The water supply for Scottsbluff is obtained from wells which are

situated in the underground gravel deposits of the North Platte River. This underground supply is capable of supplying all of the present and projected municipal and industrial demands of the city. The water is supplied by eleven wells that range in depth from 77 to 110 feet, with an average depth of 100 feet. Additional wells may be required to supplement the present wells as the demand for water increases. The present average daily demand is 4.2 million gallons, which is slightly over 25 percent of the maximum capacity of 16 million gallons per day (gpd). The highest peak demand was 11,200,000 gallons per day.

The city has four storage tanks with a total capacity of 1.1 million gallons, which equalize water supplies during periods of high consumption, or supply water in the event of a prolonged major fire. The water is distributed throughout the city in mains that vary in size from 4 to 14 inches.

The Gering municipal water system is supplied by eight wells with an average depth of 110 feet. The system has a combined pumping capacity of 6,400 gallons per minute (gpm), and an overhead storage capacity of 250,000 gallons. The average daily demand is 4,000,000 gallons, and a historic peak daily demand is 8,200,000 gpm. The system has a maximum capacity of 11,000,000 gpd.

c. Industrial

A description of the major municipal water users in the primary study area forms Appendix G.

d. Agricultural

Shallow, high production wells are used as a source of water on farms throughout Scotts Bluff County. In 1970 7.3 million gallons of water were used per day for domestic needs and livestock. This total amounts to 6,300 acre-feet of water per year. By 1985, rural domestic and livestock uses are

expected to increase to 9.2 million gallons per day, or 10,300 acre-feet per year. By 2020, an estimated 22,000 acre-feet will be required.

I. SUMMARY OF WATER QUALITY AND QUANTITY PROBLEMS

1. North Platte River

Water quality problems in the North Platte River within and downstream of the primary and secondary study areas include naturally high total dissolved solids concentrations and conductivity, a high sedimentation rate, moderately high fecal coliform concentrations downstream of the study area, and dewatering by withdrawals for irrigation.

Total dissolved solids concentrations and conductivity of the river water regularly exceeded earlier (prior to June, 1976) state water quality standards. No adverse impacts of these violations have been documented, however. Higher standards for conductivity ("not to exceed 1300 micromhos") and total dissolved solids (not to exceed 900 mg/l) have been set by the more recent standards (Nebraska Environmental Control Council, June, 1976) for segments 7, 8 and 9 of the North Platte.

The high sedimentation rate is the result of highly erodible soils, intensive cultivation in the basin, and sand and gravel mining operations within the river bed.

Fecal coliform concentrations at the McGrew sampling station (downstream from the study area) exceed state water quality standards for full body contact recreation. The river in this reach, however, is classified for partial body contact recreation, the standard for which (1000 organisms/100 ml geometric mean) has been met in recent sampling. Possible sources of fecal coliform bacteria include municipal effluent discharges in the primary study area (Scottsbluff, Gering and Terrytown) and in Minatare, Mitchell, Morrill, Henry and Lyman as well as numerous livestock feedlots.

Irrigation water withdrawals during summer months significantly alter the natural flow regime of the North Platte. Low flow characteristics vary considerably from one gaging station to the next. Dewatering of the river is partially reversed by irrigation return flows.

2. Tributary Streams

Tributary streams north and south of the North Platte receive and transport irrigation return flows from the extensive cultivated acreage within the valley. Based upon the continued survival of sensitive rainbow trout smolts in these streams north of the river, water quality degradation from the return flows does not appear to be severe.

The identified threat to trout spawning and growth in the tributary streams is adjacent land use. Sedimentation of the stream bottoms and heating of the water results from disruption of natural bank vegetation by livestock grazing (Velson, No Date).

3. Lake McConaughy

Lake McConaughy is susceptible to accelerated aging resulting from sediment and nutrient loads that are increased by man's activities. Increased sedimentation can be attributed to land cultivation and to sand and gravel mining in the river. Increased nutrient loading can be attributed to land cultivation, fertilization, feedlot runoff, and wastewater disposal.

J. WATER QUALITY MANAGEMENT RELEVANT TO THE ACTION UNDER CONSIDERATION

1. Federal Responsibilities

a. U.S. Environmental Protection Agency, Region VII - Preparation of the 201 Facilities Plans for Scottsbluff, Gering and Terrytown was partially funded by Step I construction grants funds administered by Region VII, U.S. EPA. Based upon review of the Scottsbluff facilities plan and considerable public controversy over the proposed land application of treated wastewaters,

Region VII decided to prepare an EIS on the Scottsbluff facilities plan and included Gering and Terrytown in order to evaluate the cost-effectiveness of regional wastewater management solutions. U.S. EPA Region VII is the lead agency in preparation of this E.I.S. Future federal funding of Step II and Step III grants will be administered by Region VII.

b. U.S. Department of Transportation, Federal Highway Administration

FHA and the Nebraska Department of Roads prepared a Final Environmental Impact Statement (U.S. D.O.T. and N.D.R., 1976) on a new bridge over the North Platte River with adjoining road construction and reconstruction. The bridge will be located east of the present bridge carrying State Route 71 and will extend south from 21st Avenue in Scottsbluff to a section road east of Gering. Channelization of the North Platte River with filling and revegetation of two existing channels is proposed. Detailed consideration of water quality and aquatic biota impacts of the action was provided. The bridge is a potential route for force main crossings of the North Platte River. Coordination with FHA and the Nebraska Department of Roads will be necessary if this force main route is to be utilized.

c. U.S. Corps of Engineers

Under current interpretations of Section 404, P.L. 92-500, permits to construct federally-funded projects in the flood plain of the North Platte River will have to be obtained from the U.S. Corps of Engineers. Several of the alternatives considered here include such construction.

d. U.S. Geological Survey

Routine monitoring of water quality and flows in the North Platte River is provided by the U.S. Geological Survey. Long-term North Platte River water quality data is available from U.S.G.S. for stations at the Wyoming-Nebraska state line and at McGrew, Nebraska (U.S.G.S., 1976).

2. State Responsibilities

a. Nebraska Natural Resources Commission

Water quality planning in the North Platte river basin is conducted by the Nebraska Natural Resources Commission in cooperation with other state agencies. The 303(e) plan for the North Platte River Basin was published by the Commission in 1975 (Nebraska Natural Resources Commission, 1975). In addition to inventorying point and non-point pollution sources, the "Water Quality Management Plan" prioritized the river segments and municipal discharges in the basin. A summary of the priority data is provided in Table II-10.

b. Nebraska Department of Environmental Control

Nebraska D.E.C. is the state regulatory agency for all water, air, and solid waste pollution control activities in the state. The Environmental Control Council of the Nebraska D.E.C. recently revised the state surface water quality standards (Nebraska Environmental Control Council, 1976). Specific changes of importance to this study are increases in allowable total dissolved solids concentrations and conductivity to recognize the naturally high levels and designation of stream segments 7 and 8 for "Partial Body Contact" use. The "Partial Body Contact" use allows a higher fecal coliform concentration (1000/100 ml vs. 200/100 ml geometric mean for "Full Body Contact"). The purpose for the lower use classification is not stated. It is assumed that higher fecal coliform concentrations were determined to be preferable to the chance of accidental chlorine overdoses by municipal dischargers during trout migration. The water use designations and water quality criteria for stream segments 7 and 8 are listed in Table II-11. Stream segments include designated reaches of the North Platte River and their tributaries. Locations of the stream segments are illustrated in

Table II-10

Stream Segment and Municipal Discharge Priorities in the
North Platte River Basin Set by the
Nebraska Natural Resources Commission (1975)

SEGMENT PRIORITY LIST
North Platte River Basin

<u>Priority</u>	<u>Segment</u>	<u>Name</u>
1	8	North Platte River from USGS Gage No. 6795 at Mitchell to Gering Drain (within study area)
	9	North Platte River from USGS Gage No. 6745 near Nebraska-Wyoming border to USGS Gage No. 6795 at Mitchell (above study area)
2	7	North Platte River from Gering Drain to Pumpkin Creek (below study area)

Number of Segments = 9

Number of priority Rankings = 6

MUNICIPAL PRIORITY DATA
North Platte River Basin

<u>Municipality</u>	<u>Total Points</u>	<u>Priority</u>
Scottsbluff	73	1
Gering	46	5
Terrytown	33	10

Number of Municipalities = 14

Maximum Points = 73

Minimum Points = 11

Table II-11

WATER USE DESIGNATIONS AND WATER QUALITY CRITERIA FOR THE NORTH PLATTE RIVER
AND ITS TRIBUTARIES IN AND BELOW THE STUDY AREA

NORTH PLATTE RIVER BASIN		WATER USES						CRITERIA								
		FULL BODY CONTACT	PARTIAL BODY CONTACT	FISH AND WILDLIFE	AGRICULTURAL	INDUSTRIAL	WATER SUPPLY	DISSOLVED OXYGEN (mg/l) NOT LESS THAN	CONDUCTIVITY (MICROMHOS) NOT TO EXCEED	TOTAL DISSOLVED SOLIDS (mg/l) NOT TO EXCEED	AMMONIA AS NITROGEN (mg/l) NOT TO EXCEED				FECAL COLIFORM/ GEOMETRIC MEAN (100 ml.) NOT MORE THAN	CHLORINE RESIDUAL (mg/l) NOT TO EXCEED
											W	Sp	S	F		
NUMBER	SEGMENT DESCRIPTION															
7	North Platte River from confluence of Gering Drain to confluence with Pumpkin Creek		X	X	X			6.0	1300	900	2	1	1	1	1000	0.01
8	North Platte River from confluence of Dry Spottedtail Creek to confluence with Gering Drain		X	X	X			6.0	1300	900	2	1	1	1	1000	0.01

Source: (Nebraska Environmental Control Council, 1976).

Figure II-10.

Nebraska has been granted the authority to issue discharge permits under the National Pollutant Discharge Elimination System. Permits were issued to each of the three municipalities in the primary study area in December, 1974. Permit numbers, initial effluent limitations effective until June 30, 1977, final effluent limitations effective until December, 1979 (except Scottsbluff) and schedules of compliance for each of the three municipal wastewater treatment facilities are shown in Tables II-12, 13, and 14.

c. Nebraska State Department of Health

Regulation of on-site sewage disposal systems is provided by the Division of Housing and Environmental Health, Nebraska State Department of Health. Enforcement actions against owners of improperly constructed or operated on-site systems have not been documented.

d. University of Nebraska

Data collection and research in regard to the area's natural and agricultural resources is performed at the Panhandle Station of the University of Nebraska's Cooperative Extension Service.

3. Local Responsibilities

Municipal wastewater treatment plants are owned and operated by Scottsbluff, Gering and Terrytown. The types, conditions and operation of these plants are described in their respective facilities plans.

The Panhandle Resource Council, located in Scottsbluff, is the A-95 clearing house for federal actions in western Nebraska. A-95 clearing houses examine proposed federally funded projects for their statewide or regional impacts and their relationship to state and regional comprehensive plans or policies. In addition to their review role, A-95 agencies insure that other

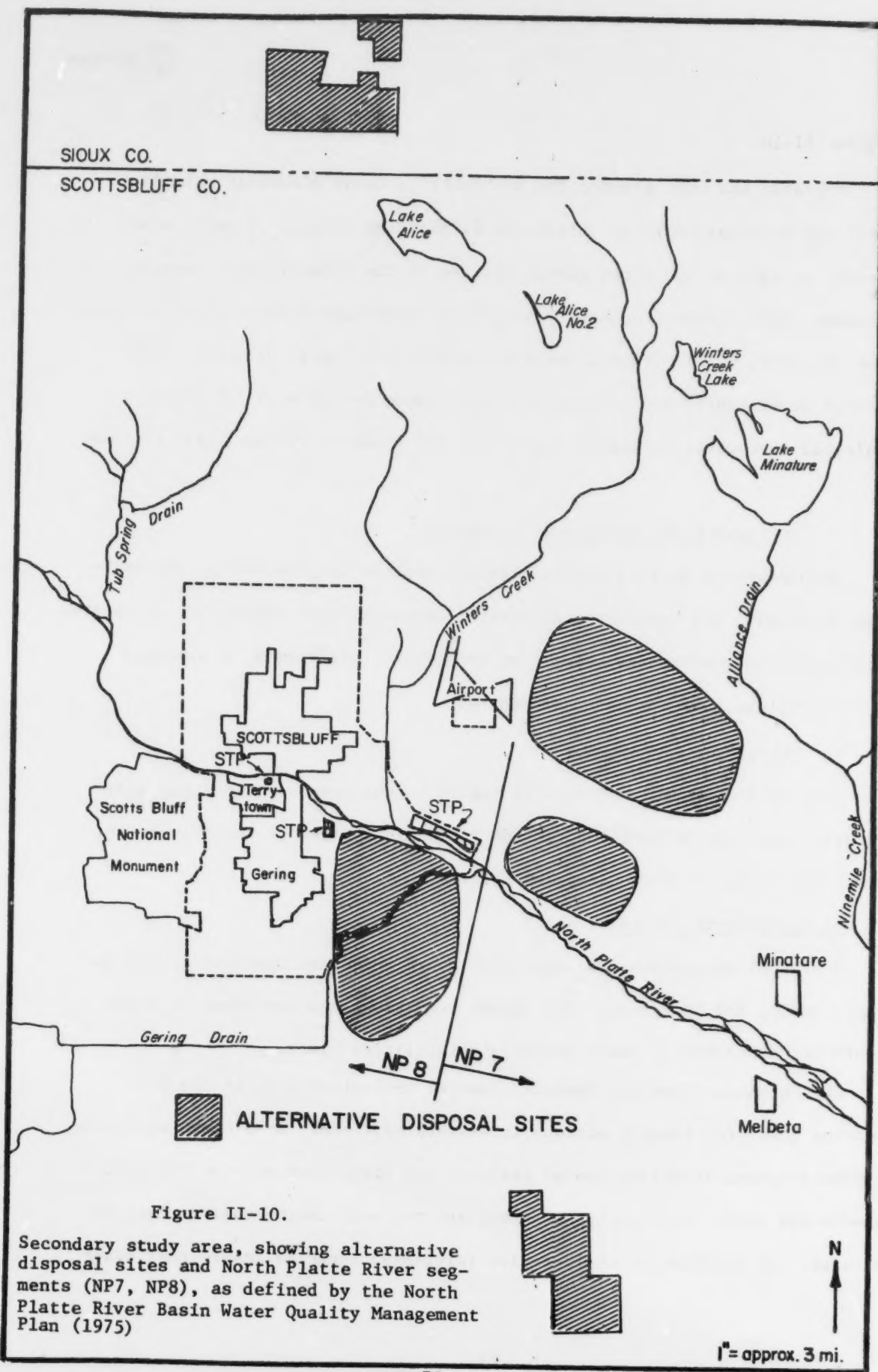


Figure II-10.

Secondary study area, showing alternative disposal sites and North Platte River segments (NP7, NP8), as defined by the North Platte River Basin Water Quality Management Plan (1975)

Table II- 12

Nebraska D.E.C. Effluent Discharge Permit Conditions
City of Scottsbluff
Permit #NE0036315

EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS - DECEMBER, 1974 to JUNE, 1977

<u>EFFLUENT CHARACTERISTICS</u>	<u>DISCHARGE LIMITATIONS</u>	<u>MINIMUM</u>	
	Concentration in mg/l Monthly Average	Measurement Frequency	Sample Type
Biochemical Oxygen Demand (5-day)	50	Weekly	grab
Suspended Solids	300	Weekly	grab
pH - standard units	6.0-9.0 (not to be averaged)	Weekly	grab
Fecal Coliform - organisms/100 ml	--	--	--
Flow - mgd	--	once each weekday (Mon.-Fri.)	--
Oil and Grease	20	Weekly	grab

SCHEDULE OF COMPLIANCE (As amended by NDEC Administrative Order and Complaint
of September 15, 1977)

1. The permittee shall achieve compliance with the effluent limitations specified for discharges in accordance with the following schedule:
 - a. Submit progress report by March 31, 1976.
 - b. Submit progress report by December 31, 1976.
 - c. Submit progress report by March 31, 1977.
 - d. Submit progress report by June 1, 1977.
 - e. Complete construction and achieve final effluent limits by June 30, 1977.*

*The final date may be modified if permittee has received a Step III construction grant prior to July 1, 1977.

Table II-13

Nebraska D.E.C. Effluent Discharge Permit Conditions
City of Gering
 Permit #NE0027936

EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

<u>EFFLUENT CHARACTERISTICS</u>	<u>DISCHARGE LIMITATIONS</u> Conc. in mg/l		<u>MINIMUM</u> <u>MONITORING REQUIREMENTS</u>	
	<u>Monthly</u> <u>Average</u>	<u>Weekly</u> <u>Average</u>	<u>Measurement</u> <u>Frequency</u>	<u>Sample</u> <u>Type</u>
<u>December 1974 - June 1977</u>				
Biochemical Oxygen Demand (5-day)	50	--	Weekly	grab
Suspended Solids	70	--	Weekly	grab
pH - standard units	6.9-9.0	(not to be averaged)	Weekly	grab
Fecal Coliform - organisms/100 ml	--	--	once each weekday (Mon.-Fri.)	--
Flow - mgd	--	--	Weekly	grab
Oil & Grease	10	15	Weekly	grab
<u>July 1977 - December 1979</u>				
Biochemical Oxygen Demand (5-day)	30	45	Weekly *annual	grab 24 hr comp
Suspended Solids	30	45	Weekly *annual	grab 24 hr comp
pH - standard units	6.0-9.0	(not to be av.)	Weekly	grab
Fecal Coliform - organisms/100 ml	200	400	Weekly	grab
Flow - mgd	--	--	once ea. weekday (Mon.-Fri.)	--
Oil & Grease	10	15	Weekly	grab

*Influent sample collection.

SCHEDULE OF COMPLIANCE (As amended by NDEC Administrative Order and Complaint of 9/15/77)

1. The permittee shall achieve compliance with the effluent limitations specified for discharges in accordance with the following schedule:
 - a. Complete facility plan for upgrading present treatment system and submit by May 31, 1976.
 - b. Submit engineering plans and specifications for departmental approval by October 31, 1976.
 - c. Begin construction by March 31, 1977.
 - d. Complete construction to achieve compliance with final effluent limitations by June 30, 1977*.

*The final date may be modified if permittee has received a Step III Construction Grant July 1, 1977.

Table II- 14

Nebraska D.E.C. Effluent Discharge Permit Conditions
Village of Terrytown
 Permit #NE0047295

EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

<u>EFFLUENT CHARACTERISTICS</u>	<u>DISCHARGE LIMITATIONS</u>		<u>MINIMUM MONITORING REQUIREMENTS</u>	
	Conc. in mg/l <u>Monthly Average</u>	<u>Weekly Average</u>	<u>Measurement Frequency</u>	<u>Sample Type</u>
<u>December 1974 - June 1977</u>				
Biochemical Oxygen Demand (5-day)	30	45	Monthly	24 hr. comp.
Suspended Solids	30	45	Monthly	24 hour comp.
pH - standard units	6.9-9.0	(not to be av.)	--	grab
Fecal Coliform - organisms/100 ml	--	--	--	--
Flow - mgd	--	--	once each weekday (Mon.-Fri.)	--
<u>July 1977 - December 1979</u>				
Biochemical Oxygen Demand (5-day)	30	45	Monthly *annual	24 hr comp. 24 hr comp.
Suspended Solids	30	45	Monthly *annual	24 hr comp. 24 hr comp.
pH - standard units	6.0-9.0	(not to be av.)	Monthly	grab
Fecal Coliform - organisms/100 ml	200	400	Monthly	grab
Flow - mgd	--	--	once each weekday (Mon.-Fri.)	--

*Influent sample collection only.

SCHEDULE OF COMPLIANCE

1. The permittee shall achieve compliance with the effluent limitations specified for discharges in accordance with the following schedule:
 - a. Complete facility plan for disinfection facilities and submit by December 31, 1975.
 - b. Submit engineering plans and specifications for departmental approval by February 29, 1976.
 - c. Begin construction August 31, 1976.
 - d. Complete construction of disinfection facility by March 31, 1977.
 - e. Achieve compliance with final effluent limits by June 30, 1977.

potentially interested governmental and non-governmental agencies are notified of proposed federal actions in their area of concern.

K. TERRESTRIAL BIOLOGY

1. Terrestrial Vegetation - General

The semi-arid climate of the study area prevents the growth of trees except in the Wildcat Hills area and along the North Platte River and its tributaries. Native grasses are the dominant vegetation type except where extensive irrigation agriculture is practiced. The native grasses are a part of the prairie formation which extends southward from Saskatchewan and Alberta to eastern Texas and westward from Indiana to the woodland zone of the Rocky Mountains. The grassland or prairie is the largest formation in North America and a considerable amount of environmental variation exists within its boundaries. Grasses are adapted to this environmental diversity because of their growth form, long periods of dormancy, and critical moisture requirements (primarily in spring and early summer).

The most common grasses of the Panhandle section of Nebraska are upland species including sideoats grama (Bouteloua curtipendula), prairie dropseed (Sporobolu heterolepis), needlegrass (Stipa spartea), little bluestem (Andropogon scoporius), and junegrass (Koeleria cristata). These grasses are present in those parts of Scotts Bluff County that are now used as rangeland. Within the secondary study area large contiguous acreage of upland grasslands are found in the bluff and plateau areas bordering the river valley on the north and south. Substantial grassland acreage is also found between the northern bluff areas and the highest irrigation canal below the bluffs, the Interstate Canal. The "North" irrigation site is located within this upland grassland.

Below the most elevated irrigation canals, grassland occurs in steep slope areas that cannot be irrigated, and over lowland soils which are alkaline and saline due to the evapotranspiration of groundwater from within the root zone of plants. Rapid evapotranspiration of this groundwater leaves behind high concentrations of mineral solids in the soil. Inland saltgrass, alkali sacaton, and western wheatgrass are the most common native grasses in the alkaline soil areas (Minatare-Janise association) north of the river and east of the Scottsbluff lagoon system.

Vegetation bordering the North Platte River contrasts sharply with the shortgrass prairies and cultivated lands in the region. The moisture regime in the floodplain of this river and its tributaries permits the growth of deciduous trees. Local moisture conditions also permit the growth of trees on hillsides or low areas throughout the proposed project area. The most important tree species along the North Platte River are eastern cottonwood (Populus deltoides) and willow (Salix). The shifting nature of the North Platte River causes the development of sand and gravel bars. Willow and cottonwood trees become established on these new bars and form almost pure stands. Many eastern cottonwood specimens are eight to fifteen inches in diameter. Other less common species are American elm (Ulmus americana), boxelder (Acer negundo), and Russian olive (Elaeagnus angustifolius).

Herbaceous vegetation observed along the North Platte consists mostly of weeds or lowland plants. In some of the slough areas cattails (Typha latifolia) have become well established. Other lowland plants are canary grass (Phalaris sp.) and cordgrass (Spartina pectinata). Other herbaceous species include:

Carduus sp.

Chemopodium sp.

Carex sp.

Rumex sp.

Scirpus sp.

Solidago sp.

2. Terrestrial Vegetation - Alternate Land Application Sites

Vegetation types at the five alternate sites for agricultural irrigation or complete retention are:

- North Site -- upland grassland used as range for livestock
- South Site -- cultivated to wheat; not irrigated
- North Valley Irrigation Area -- cultivated to row crops; irrigated
- South Valley Irrigation Area -- cultivated to row crops; irrigated
- Valley Complete Retention Area -- salt-tolerant grasses; used as permanent pasture for livestock.

3. Rare and Endangered Terrestrial Species

The following species were cited in Nebraska's Rare and Endangered Wildlife (Nebraska Game and Parks Commission, 1973) as being rare, endangered, and having some probability of occurrence in the secondary study area.

a. Endangered Species

Black-footed ferret (*Mustela nigripes*, Audubon and Bechman) -- This animal is one of the rarest North American mammals. The most recent record of this ferret in Nebraska is from 1959. The most important factor governing the existence and distribution of this mammal is the existence of prairie dog towns. Since the predominantly agricultural study area has few prairie dogs, the existence of this ferret here is unlikely.

Swift Fox (*Vulpes velox*) -- This small fox has been greatly reduced in numbers by predator control operations aimed at coyote control. Its habitat has been restricted by conversion of grassland to agricultural use.

Whooping Crane (*Grus americanus*, Linnaeus) -- The migration route of this rare bird includes the North Platte River Valley. During the spring and fall, occasional stops have been reported on Lake McConaughy on the North Platte River.

American Peregrine Falcon (*Falco peregrinus anatum*) -- This falcon is known to occur occasionally in the North Platte Valley during migration and as a winter resident. This raptor, due to its sharp decline in the eastern United States, is considered to be one of the rarest birds in the United States. In Nebraska, it is most commonly observed in the panhandle (Nebraska Game and Parks Commission).

b. Rare Species

Black-Tailed Prairie Dog (*Cynomys ludovicianus* Ord) -- This mammal has been drastically reduced in numbers throughout much of its former range. Protection has been afforded to these mammals on land administered by state or federal agencies. The placement of this mammal in the rare category is subject to question, since this prairie dog is present on privately owned land throughout Nebraska. Its presence in the project area is quite probable. This species was classified as rare in the 1972 "Nebraska Fish and Wildlife Plan" but not in the 1973 "Nebraska's Rare and Endangered Wildlife."

Greater Sandhill Crane (*Grus canadensis tabida*) -- This bird migrates through Nebraska with the Lesser Sandhill Crane. Although its occurrence in the North Platte River Valley is now known, it is possible that this crane stops here during migration.

Trumpeter Swan (*Olor baccinator*) -- This bird occurs in Nebraska primarily in a migratory capacity and exists nowhere else in the world in substantial numbers. It breeds occasionally in a few areas of the sandhills.

Bald eagle (*Haliaeetus leucocephalus*) -- Current management practices

may not be adequate in preventing the decline of this bird, and there is need of additional study and corrective measures to assure its survival. It is an uncommon migrant in Nebraska and a common winter resident along portions of the Platte River and certain large reservoirs where large duck populations winter.

Sage Grouse (*Centrocercus urophasianus*) -- Although this grouse has declined in numbers in recent years, unconfirmed strutting grounds have been reported in Sioux County.

4. Furbearers

Only beaver, muskrat, and mink are officially classified as furbearers by the State of Nebraska, although foxes, raccoons, coyotes, bobcats, badgers, spotted and striped skunks, and opossums also are likely to be found in the study area. Trapping activities in Nebraska have experienced a sharp decline in the early 1950's, which can be attributed to an unfavorable market for furs, habitat losses, and a general lack of interest in trapping.

5. Big Game

a. Deer

Both mule and white-tailed deer are present throughout the panhandle section of Nebraska. Mule deer greatly outnumber white-tail by a ratio of ten to one. The white-tails are most abundant along the North Platte River and its tributaries where the timber provides cover and protection. In other habitat types, mule deer are more abundant.

b. Antelope

Antelope normally inhabit grasslands and moderate to high populations are present in the counties of the Nebraska Panhandle. Sioux County is known to support high antelope populations. Careful management of this animal throughout its range prevents overharvest.

c. Turkey

The more heavily timbered reaches of the Panhandle support populations of the Merriams and Rio Grande turkeys. Wildcat Hills near Scottsbluff support a small turkey population.

6. Upland Game

a. Ring-Necked Pheasant

Pheasants occur in low numbers in the Scottsbluff vicinity. The populations in the Panhandle are known to occur in Box Butte and Sheridan Counties.

b. Bobwhite Quail

These birds are restricted almost entirely to the North Platte River and its tributaries, where the woodlands provide adequate cover. Quail hunting access is limited because waterfowl hunters lease the quail habitat along the streams.

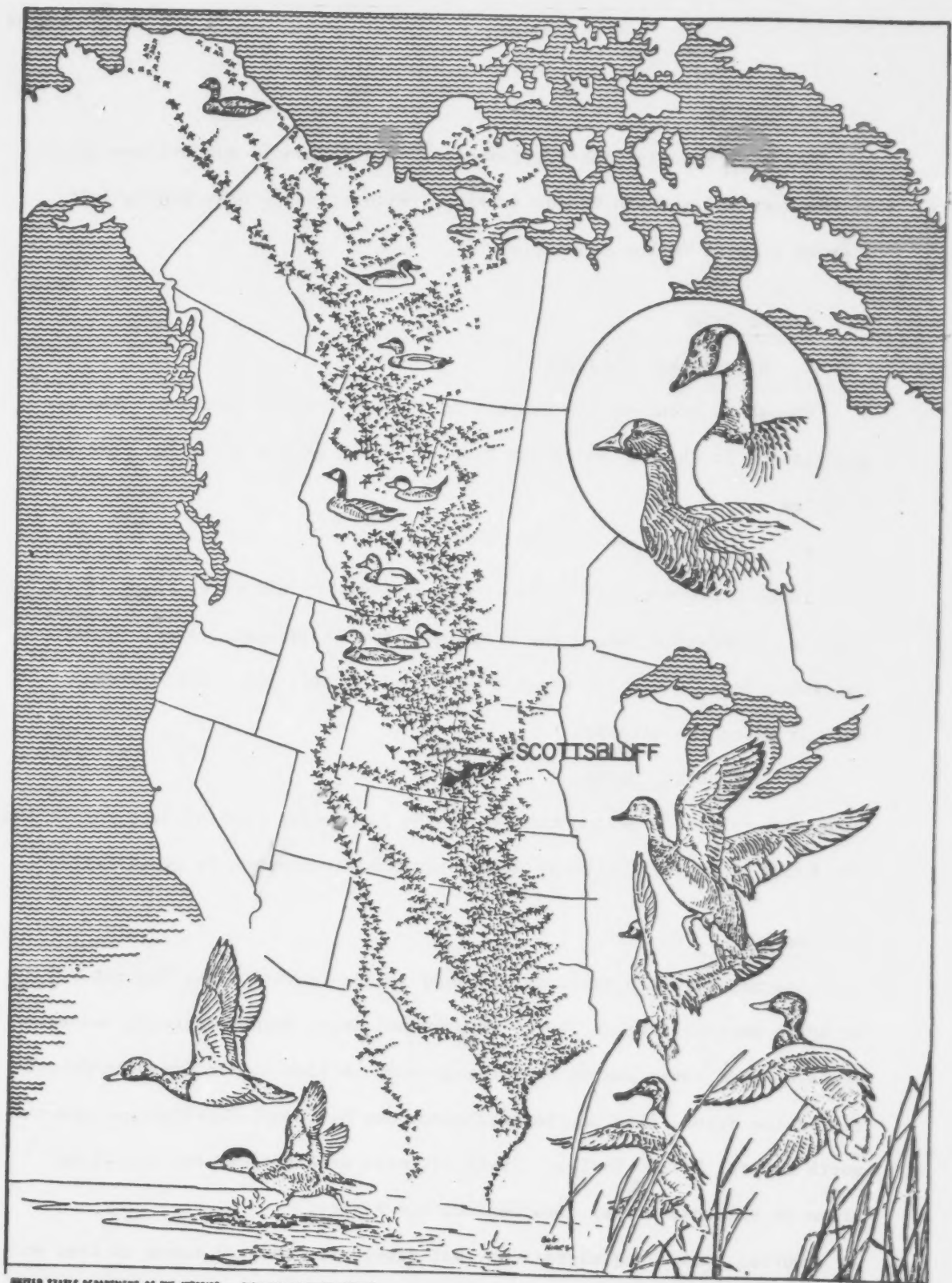
c. Cottontail Rabbit

This rabbit is scarce throughout the Panhandle. The highest populations are found in the agricultural areas, but hunter interest is generally low.

7. Waterfowl

Scottsbluff, Nebraska, is situated in the center of the Central Flyway of North America (Figure II-11. Ducks and geese migrate through western Nebraska from their summer breeding grounds in Alaska, the Canadian provinces of the Yukon, Alberta, Saskatchewan, the Northwest Territories, and the north central United States. Their ultimate destinations are wintering areas in Oklahoma, Texas, New Mexico, and Mexico.

During their long migrations, waterfowl stop several times to feed and rest. As cold weather intensifies, the birds move progressively farther



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Figure II-11. Central Flyway, showing the location of Scottsbluff

south. In the Great Plains regions of western Nebraska, water is scarce, and most sewage treatment lagoons, rivers, and lakes are used as resting and feeding habitat by migratory waterfowl. Thirteen species of ducks observed at the Scottsbluff sewage lagoons during facilities inspections October 19 and 20, 1976, from most to least abundant, were: gadwall, mallard, green-winged teal, Northern shoveler, ruddy duck, American widgeon, ring-necked duck, lesser scaup, pintail, blue-winged teal, redhead, canvasback, and buffle head. No geese were seen, but these larger birds usually do not reach this region until early November. The Canada goose is the most abundant species, but snow geese and white-fronted geese generally are well represented.

Some of the ducks that were observed on the lagoons are migrants, but at least nine species nest locally in western Nebraska.

The five most abundant ducks that migrate through the Scottsbluff area are the mallard, green-winged teal, American widgeon, gadwall, and common merganser.

L. AQUATIC BIOLOGY

1. Habitat

The Nebraska Parks and Game Commission (1972) has classified the waters of the state as to their importance as sports fisheries. In the project area the North Platte River is classified as "degraded." The degraded classification is defined as waters of little use because of water withdrawal or pollution.

The northern tributaries to the North Platte River are classified as coldwater habitat, those from the south as warmwater, and the North Platte River (i.e., the mainstem) as both cold and warmwater habitat.

The project area contains several coldwater streams that can support trout. The coldwater streams tributary to the North Platte are all located north of the North Platte River and are fed by groundwater from the sand and

gravel terrace deposits. They include the North Platte River, Tub Springs, Winters Creek, Wet Spottedtail Creek, and Dry Spottedtail Creek. These streams were previously classified Class A streams on the basis of their ability to support trout. Recent state water quality standards (Nebraska Environmental Control Council, 1976) do not distinguish between cold and warm water streams on the basis of habitat capabilities.

Three lakes north of Scottsbluff support fish populations: Lake Alice (776 acres), Lake Minatare (2,158 acres), and University Lake (20 acres). Lake Alice and Lake Minatare are filled by the North Platte River during the irrigation season, but when the irrigation is completed Lake Alice drains completely into Lake Minatare.

2. Fisheries

Thirteen families of fishes are represented in the North Platte River Basin. Notable fish species include trout, largemouth bass, white bass, walleye, northern pike, yellow perch, bluegill, channel catfish, carp, and black bullhead. A list of the fish species occurring in the Basin is shown in Table II-15.

3. Rare and Endangered Fish

Nebraska has classified certain species of fish as rare and endangered, as listed in Table II-16; however, no species endemic to the project area are included in this list.

4. Trout

Trout are the most important sport fish of the North Platte River and its tributaries. Lake McConaughy is the only reservoir on the Great Plains that contains a naturally reproducing trout population. Fishermen utilize the streams for trout fishing during migration periods, but Lake McConaughy

Table II-15

Fishes of the North Platte River Basin

Clupeidae - herrings

Dorosoma cepedianum (Lesueur)-gizzard shad

Hiodontidae - mooneyes

Hiodon alosoides (Rafinesque)-goldeye

Salmonidae - trouts and whitefishes

Salmo gairdneri Richardson-rainbow trout

Salmo trutta Linnaeus-brown trout

Esocidae - pikes

Esox lucius Linnaeus-northern pike

Cyprinidae - minnows and carps

Cyprinus carpio Linnaeus-carp

Notropis cornutus (Mitchill)-common shiner $\frac{1}{2}$

Phoxinus eos (Cope)-Northern redbelly dace $\frac{2}{2}$

Catostomidae - suckers

Carpiodes carpio (Rafinesque)-river carpsucker.

Carpiodes cyprinus (Lesuer)-quillback

Catostomus catostomus (Forster)-longnose sucker $\frac{1}{2}$

Catostomus commersoni (Lacepede)-white sucker

Ictiobus cyprinellus (Valenciennes)-bigmouth buffalo

Moxostoma macrolepidotum (Lesueur)-shorthead redhorse

Ictaluridae - catfishes and bullheads

Ictalurus melas (Rafinesque)-black bullhead

Ictalurus punctatus (Rafinesque)-channel catfish

Noturus flavus Rafinesque-stonecat

Noturus gyrinus (Mitchill)-tadpole madtom

Pylodictis olivaris (Rafinesque)-flathead catfish

Cyprinodontidae - topminnows

Fundulus kansae Carman-plains killifish

Fundulus sciadicus Cope-plains topminnow

Gasterosteidae - sticklebacks

Culaea inconstans (Kirtland)-brook stickleback

Percichthyidae - sea basses

Morone chrysops (Rafinesque)-white bass

Morone saxatilis (Walbaum)-striped bass

Table II-16 Rare and Endangered Fish of Nebraska

Ichthyomyzon castaneus - Chestnut lamprey. Range status: Peripheral.

Acipenser fulvescens - Lake sturgeon. Present status: Endangered.

Scaphirhynchys albus - Pallid sturgeon. Present status: Rare.

Hybopsis gelida - Sturgeon chub. Present status: Rare.

Nocomis biguttatus - Hornyhead chub. Present status: Rare.

Phoxinus eos - Northern redbelly dace. Present status: Rare.

Phoxinus neogaeus - Finescale dace. Present status: Rare.

Semotilus margarita - Pearl dace. Present status: Rare.

Rhinichthys atratulus - Blacknose dace. Present status: Rare

Pimephales notatus - Bluntnose minnow. Range status: Peripheral.

Ictiobus niger - Black buffalo. Present status: Rare.

Moxostoma erythrurum - Golden redhorse. Present status: Rare

Ictalurus furcatus - Blue catfish. Range status: Peripheral.

Reported by: Quintin Bliss, Nebraska Game and Parks Commission,
Lincoln.

Source: Lopinot, A. C. 1975

Ichthyomyzon unicuspis - Silver lamprey. Status: Peripheral.

Notropis heterolepis - Blacknose shiner. Status: Rare.

Notropis topeko - Topeko shiner. Status: Rare.

Hiodon terogisus - Mooneye. Status: Peripheral.

Hybopsis plumbea - Lake chub. Status: Peripheral.

Percina malculata - Blackside darter. Status: Undetermined.

Source: Nebraska Game and Parks Commission, 1972.

is fished the year round.

Most trout travel up the North Platte River and spawn in tributary streams. There are two segments within the rainbow trout population: fall spawners (November and December) and spring spawners (March). After spending their first year in the stream where they hatched, they have reached a size of 7 to 10 inches and are called smolts. At this time they migrate to Lake McConaughy, where they mature for a period of two years. At maturity, the trout use their sense of smell to migrate back to their home stream for spawning. Local coldwater streams are stocked with trout to supplement natural reproduction.

Water and habitat requirements for trout include:

- Water temperature not exceeding 70°F for extended period of time
- Dissolved oxygen of 5 PPM or more
- Clean clear water without silt or pollution
- Spawning beds with bubbling springs for reproduction

Rainbow trout tolerate water temperature from about 32°F to 80°F. However, they prefer temperatures below 70°F. They also prefer well-oxygenated water with dissolved oxygen levels of 5.0 parts per million or greater. The pH can range from 5.8 to 9.5. Trout prefer gravel riffles of moderate gradient for spawning. Usually riffles with springs bubbling up from below are ideal.

Trout feed on immature and adult aquatic insects (Caddisflies, mayflies, and dipterans).

5. Sport Fishery

The main sport fisheries in the study area are the rainbow trout population that migrates from Lake McConaughy to spawn in local tributaries, and brown trout that stay in the tributaries. Data reported by Peterson (undated)

summarizing voluntary tag returns of fall and spring run rainbow trout spawners for 1967 through 1975 indicate that 20 tags from Tub Springs Creek and five from Winters Creek were returned. This represents 18.5 percent of the total number of tags returned and a rainbow trout population of approximately 1800 fish in these two streams. Similar data on the brown trout population do not exist.

Channel catfish reportedly have been caught in the North Platte River, but no catch data are available.

6. Commercial Fishery

There are no commercial fisheries in the secondary project area.

M. AMBIENT AIR QUALITY

Scottsbluff is in the Nebraska Intrastate Air Quality Control Region (NIAQCR) which encompasses the State of Nebraska, except for Dakota, Gage, Jefferson, Lancaster, Sarpy, and Thayer Counties. Nebraska's Implementation Plan for the attainment and maintenance of air quality standards, approved September 8, 1975, by EPA, placed the NIAQCR in a Priority III category for all pollutants, which basically means that the region's air quality was considered to be in compliance with the federal primary and secondary ambient standards.

Twenty-four hour average total suspended particulate levels are measured in Scottsbluff once every 12 days by the Nebraska Department of Environmental Control, using a high-volume air sampler. Table II-17 summarizes the observed concentrations for the years 1972-1975. The violation frequency data are based on statistical analyses of the available samples for each year.

As is evident from the data, the primary annual standard of 75 ug/m^3 is estimated to have been violated in three out of the last five years. In

Table II-17

SCOTTSBLUFF TOTAL SUSPENDED PARTICULATE SUMMARY

Year	Samples	Geom. Mean* ($\mu\text{g}/\text{m}^3$)	Geom. Standard Deviation	Estimated Excesses of 24-Hr. Ambient Standards	
				Primary Std. ($260 \mu\text{g}/\text{m}^3$)	Secondary Std. ($150 \mu\text{g}/\text{m}^3$)
1971	NA	82.8	NA	NA	NA
1972	22	74.0	2.0	13	57
1973	28	70.5	1.7	2	30
1974	25	79.5	1.4	0	12
1975	26	82.4	1.6	3	38

* Primary annual standard (to protect health) is $75 \mu\text{g}/\text{m}^3$, secondary standard (to protect welfare) guidelines is $60 \mu\text{g}/\text{m}^3$.

SOURCE: (Nebraska Department of Environmental Control, Division of Air Pollution Control 1972, 1973, 1974, 1975)

addition, in all but one of the last four years the primary and secondary 24-hour standards were violated.

The concentrations of gaseous air contaminants, such as carbon monoxide, hydrocarbons, nitrogen dioxide and sulfur dioxide, are not measured in the Scottsbluff area by the Nebraska Department of Environmental Control; however, the levels may be inferred to be low based on the emission sources known to be in the area. There are four sugar beet plants in Scottsbluff, but their potential particulate emissions have been brought into compliance with the applicable standards through the utilization of scrubbers. There is also a petroleum refinery in the area. All of these installations, as well as the existing wastewater treatment facilities, have the potential to emit odorous substances on occasion. The local power plant is fired with either natural gas or low sulfur distillate oil, and as such is not a large emission source when properly operated.

Air contaminant emission sources in the area are regulated by the Nebraska Department of Environmental Control in Lincoln, Nebraska. This agency is in turn responsible for the implementation of federal regulations to EPA's Region VII office, headquartered in Kansas City, Missouri.

Air quality problems related to the existing wastewater treatment facilities are caused by periodic open burning of accumulated hair, oil, and grease scum on Gering's three anaerobic industrial lagoons and by seasonal (spring) odors from the lagoons in Gering and Scottsbluff after melting of the ice cover.

N. LAND USE

1. Agricultural

a. History and Practices

The first attempts to farm the prairies of western Nebraska were often

unsuccessful. The highly erodible prairie soils were susceptible to windstorms, and periodic droughts ruined many crops. In 1888 the first large irrigation canals were constructed to divert water from the North Platte River to the farmland. By 1895, 118 miles of canals had been built. The use of the North Platte River and its tributaries as a source of irrigation water continued to increase, and many hundreds of miles of irrigation canals are now present in Scotts Bluff County. (See Figure II-7.)

With the advent of modern spray irrigation techniques, the use of groundwater for irrigation purposes became important. The concentrations of irrigation wells for 1967 in the secondary study area are shown in Figure II-12. The number of wells has increased since 1967. As of 1 January 1976, 381 wells are used for irrigation in Scotts Bluff County and 126 in Sioux County. The number of acres that were irrigated by these wells for 1972-1975 is shown in Table II-18. Some of these wells are used to supplement the water that is supplied by ditch irrigation.

Three basic types of agriculture are practiced in the study area: irrigation of row and cover crops, dry farming, and ranching. Row crops grown on the irrigated land are corn, sugar beets, wheat, dry edible beans, oats, barley, and potatoes.

Dry farming is practiced with crops (corn, wheat) in several areas. The control of wind erosion is one of the most important factors in any dry farming practice. This is done primarily by keeping the land in a growing crop as much of the time as possible. When the land is not in a growing crop, mulch is used to prevent soil erosion by reducing the wind velocity at the ground level and providing some ground cover. Also, trees provide windbreaks which help to control soil erosion.

Ranching is the third type of farming in Sioux and Scotts Bluff Counties. It is generally restricted to the drier upland areas such as Wildcat Hills.

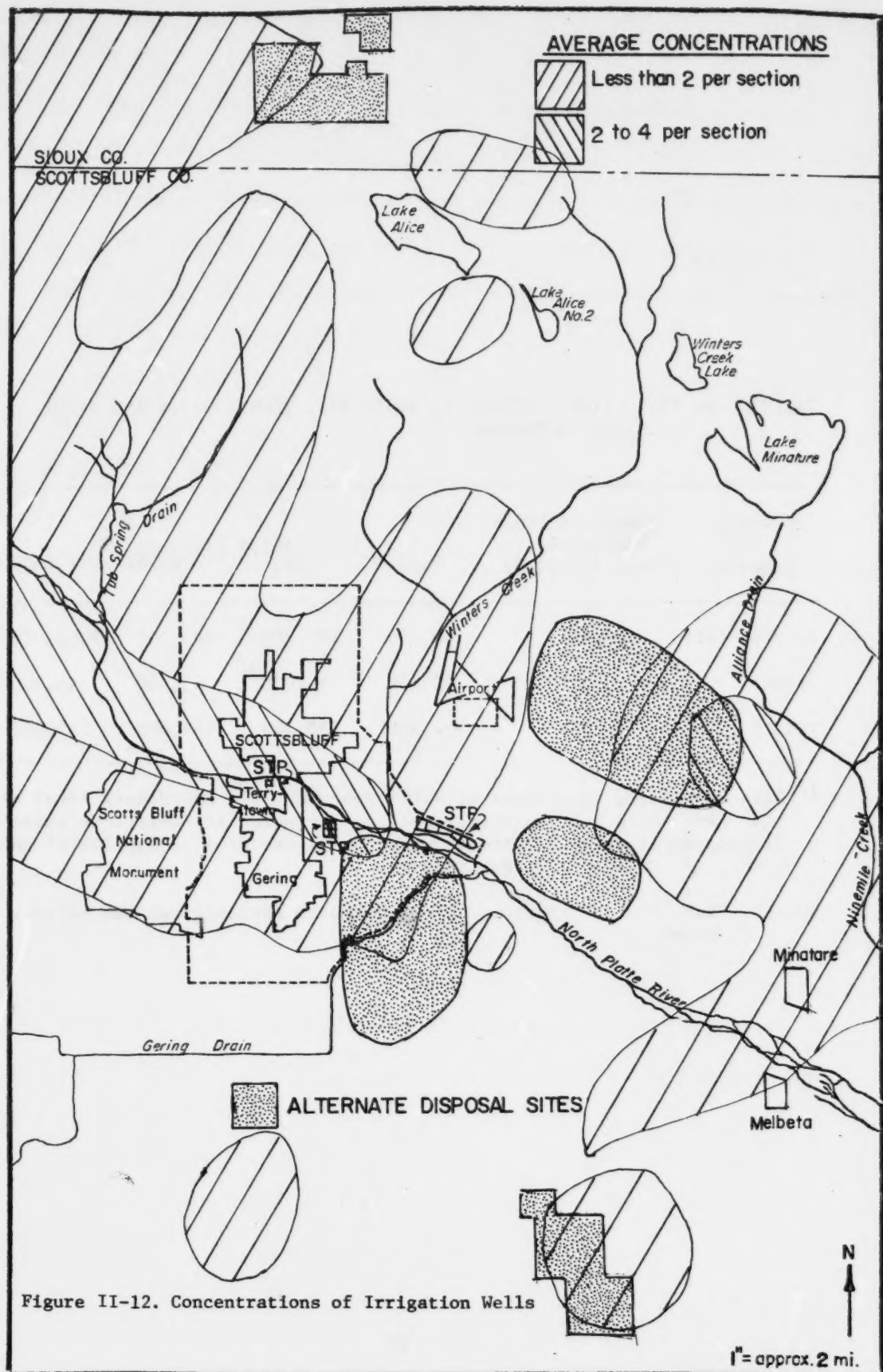


TABLE II-18. IRRIGATION STATISTICS, 1972-1975, SCOTTS BLUFF AND SIOUX COUNTIES, NEBRASKA.

County and District	Number of Wells Registered to Jan. 1, 1976 ^{1/}	Total Acres Irrigated ^{2/}			
		1972	1973	1974 ^{4/}	1975 ^{5/}
Scotts Bluff	381	190,400	195,700 ^{3/}	203,700 ^{3/}	206,000 ^{3/}
Sioux	126	42,500	43,000 ^{3/}	45,900 ^{3/}	46,000 ^{3/}
TOTALS	507	232,900	238,700	249,600	252,000

^{1/} Data from State Department of Water Resources. ^{2/} Represents total acres that have wells available and could be irrigated if conditions warrant.
^{3/} Some duplication of acreage where wells are used to supplement canal water. ^{4/} Revised. ^{5/} Preliminary.

SOURCE: Neb. Dept. Agric. 1976. Nebraska Agricultural Statistics.
p. 86.

Native prairie grasses provide feed for the cattle, but this diet is often supplemented by corn or alfalfa hay. Sheep, cattle, and hogs are the most common animals raised on these farms.

b. Land Committed to Agricultural Use

Data on agricultural acreage is reported for Scotts Bluff County and cannot readily be reapportioned to the secondary study area because it is smaller than the county, but also contains a small part of Sioux County. Irrigated land occupies 187,900 of the 464,640 total acres in Scotts Bluff County, or 40 percent. Based on 1974 and 1975 harvested acreage for crops that are typically dry farmed (Nebraska Department of Agriculture, 1976), another 27,100 acres, or about six percent, are cultivated. Six percent, or 27,976 acres, are non-agricultural, and the remaining 48 percent (221,664 acres) is range, permanent pasture, or vacant land. A breakdown of irrigated and dry-farmed land by crop produced is presented in Table II-19. Corn, dry edible beans, and sugar beets are the major irrigated crops. Wheat is the major dry-farmed crop. Livestock on farms at the beginning of 1975 included 129,000 cattle, 11,500 hogs, 44,300 sheep, and 5,600 chickens.

2. Non-Agricultural Land Use

a. General

Table II-20 gives a breakdown of non-agricultural land use.

b. Water

The primary bodies of water in the county are Lake Alice, Lake Minatare, and the North Platte River. Lake Alice, located 9 miles north of Scottsbluff, has a surface area of 776 acres. Lake Minatare, 9 miles northeast of Scottsbluff, covers 2,158 acres (Neb. Nat. Resour. Comm., 1975). The North Platte River and various smaller streams account for the remaining 9,226 surface acres of water in Scotts Bluff County.

Table II-19

ACRES HARVESTED, PRODUCTION AND YIELD PER ACRE
FOR IRRIGATED AND DRYFARMED CROPS IN SCOTTSBLUFF COUNTY, 1975^a

<u>Crop</u>	<u>Acres Harvested</u>	<u>Production</u>	<u>Yield</u>
<u>Irrigated</u>			
Corn for grain	38,500	3.27 mill. bu.	85 bu./ac.
Corn for silage	10,000	.2 mill. bu.	20 bu./ac.
Sorghum for grain	100	5. thou. bu.	50 bu./ac.
Wheat	500	20. thou. bu.	40 bu./ac.
Dry Edible Beans	46,700	76.2 mill. lbs.	.8 tons/ac.
Alfalfa Hay	20,000	76 thou. tons	3.8 tons/ac.
Sugar Beets	40,900	815.6 thou. tons	19.9 tons/ac.
	<u>156,700</u>		
Other Irrigated	31,200		
Total	<u>187,900^b</u>		
<u>Dryfarmed</u>			
Corn for grain	800	26.4 thou. bu.	33 bu./ac.
Corn for silage	200	1.2 thou. bu.	6 bu./ac.
Wheat	18,000	540. thou. bu.	30 bu./ac.
Oats	1,800	82.8 thou. bu.	46 bu./ac.
Barley	600	21. thou. bu.	35 bu./ac.
Rye	300	6.3 thou. bu.	21 bu./ac.
Alfalfa Hay	300	270	.9 tons/ac.
Wild Hay	3,300	2 thou. tons	.6 tons/ac.
Other Farm Hay	1,800	1.8 thou. tons	1 ton/ac.
	<u>27,100</u>		

^a From Nebraska Agricultural Statistics (Nebraska Department of Agriculture, 1976).

^b Total irrigated acreage as reported in the Scottsbluff County Comprehensive Plan (1974). "Other Irrigated" acreage is the difference between this total and the sum of reported crop acreages.

TABLE II-20

NON-AGRICULTURAL LAND USE IN SCOTTS BLUFF COUNTY, NEBRASKA

Land Use ^c	Acres ^c	Percent of Non-Agricultural Total	Percent of County Total ^b
Water	12,160.0	43.5	2.6
Public Lands	10,677.0	38.2	2.3
Incorporated Area	4,162.0	14.9	0.9
Residential	<u>976.6</u>	<u>3.5</u>	<u>0.2</u>
Total	27,975.6	100.1 ^a	6.0

^aTotal not equal to 100.0 due to rounding.

^bCounty total equals 464,640.0 acres.

^cSOURCE: Bell, Galyardt and Wells, Inc. 1976. Environmental assessment - water irrigation facilities - north site - Scottsbluff, Nebraska. p.13.

c. Public Lands

North Platte National Wildlife Refuge, Scotts Bluff National Monument and the Scotts Bluff County Airport are the major public lands in the county. Lakes Alice and Minatare, combined with a small amount of land around each lake, comprise the Refuge (2,934+ acres). Scotts Bluff National Monument (2 miles west of Gering) and Scotts Bluff County Airport (3.5 miles east of Scottsbluff) occupy relatively small amounts of land. The Scotts Bluff-Banner County line extends through Wildcat Hills Game Preserve. The Preserve is 8 miles south of Scottsbluff.

d. Incorporated Areas

The Cities of Scottsbluff and Gering and the Village of Terrytown form a single urbanized area divided by the North Platte River. All of the major industrial, commercial, and residential land uses in the Primary Study Area are located within the incorporated limits of these municipalities.

The major industrial land uses in Scottsbluff are adjacent to the east-west oriented Beltline Highway which roughly parallels the river. Commercial land use centers on Broadway Avenue (Route 71), the Beltline and 27th Street. Future industrial development is anticipated to take place to the east and south of the city (Scotts Bluff County, Nebraska - Comprehensive Plan, 1970). Residential development is expected to the north and west.

Major industrial land uses in Gering are in the north section of the city along 10th Street (Nebraska 71) and to the east of the city. An industrial park which includes Lockwood Corporation is developing southeast of the city. Commercial development is located chiefly along 10th Street. Residential development is occurring to the west and south of Gering. Future industrial development would likely occur in the industrial park and to the east of the city.

e. Land Use Planning

Comprehensive land use planning in Scotts Bluff County is administered by a nine-member County Planning Commission. The Commission issued a three volume comprehensive plan in April 1970, consisting of 1) a Guide for Future Development, 2) a Population and Economic Study, and 3) the Zoning and Sub-division Regulations. The planning area which is administered by the County Planning Commission consists of all of the incorporated areas of Scotts Bluff County except those areas within the jurisdiction of cities and villages.

Development of the county's resources is guided by the objectives set forth in the Comprehensive Plan. The Plan seeks to assure "effective and economic use of land and encourages coordination and harmony between activities on the land," to provide "maximum development of resources for the benefit of the entire county, thus avoiding waste of these resources, as well as discouraging wholesale exploitation of the environment for the benefit of a few," (Comprehensive Plan - Scotts Bluff County, Nebraska, 1970).

State enabling legislation gives the cities and county the power to zone land. Zoning is the principal regulatory measure used to implement the Comprehensive Plan through application to the development of private land. The general purpose of zoning is to conserve and enhance the "health, safety, morals, and general welfare" of a community (Comprehensive Plan - Scotts Bluff County, Nebraska, 1970). Among other things, the intent of the Scotts Bluff Comprehensive Plan is to provide adequate water and sewage control.

The Scottsbluff Planning Commission also consists of nine members. The city's planning and development activities are guided by a General Development Plan prepared in 1966. Future development, according to the plan, "should be encouraged, and, if practical, forced to form a continuation of existing development, taking into account the provision of desirable

permanent open space. New development should not be scattered and disjointed so as to increase the cost of supplying services and facilities. Utility extension policies should be designed and administered so as to enforce this policy" (General Development Plan, City of Scottsbluff, Nebraska, 1966).

The City of Gering's Comprehensive Plan is under revision at present and is not available for discussion.

Terrytown has no comprehensive plan.

Panhandle Resource Council, the regional A-95 clearinghouse, located in Scottsbluff, is involved in a number of activities including human resources, irrigation planning, recreation planning, and drainage problems. However, they do not become involved in comprehensive planning at the local or county level unless requested by the local jurisdiction involved.

O. RECREATIONAL RESOURCES

There are several parks and recreational areas within the study area. Most renowned, of course, is the Scotts Bluff National Monument, located three miles west of Gering. This geologic structure is a remnant of the high prairie which has eroded away over the millennia. Capped by weather resistant sandstone, Scotts Bluff rises to an elevation of 4649 feet above mean sea level, approximately 700 feet above the City of Gering. It was a landmark for settlers traveling the Oregon and Mormon Trails to more westerly destinations. Designated a National Monument in 1919, the National Park Service maintains a museum, offices, and public services in the five square miles within the park boundaries. Annual visitation to the park is on the order of 150,000 to 200,000 people.

The depression in the south side of Scotts Bluff was named Mitchell Pass by early travelers. Nearby is the site of Fort Mitchell and the trail through Roubadeau Pass.

Lake Alice, Lake Minatare, and Winters Creek Lake, located in the northwest corner of the study area, are part of the North Platte Valley irrigation system. A portion of the land surrounding Lake Minatare has been developed by the State for picnicking, fishing, boating and camping. A portion of land around all of the lakes has been designated as the North Platte National Wildlife Refuge. An estimated 3000-5000 people per year utilize the lake areas.

A U.S. Bird Preserve is located two miles west of Scottsbluff, adjacent to the North Platte River.

Scottsbluff has approximately 104 acres of parks within its boundaries. Proposed park land includes additions to Riverside Park, located along the North Platte River approximately one-half mile west of the Nebraska 71 bridge. Lacy Park, a 20-acre park located two miles east of Scottsbluff, is used for picnicking.

Gering has about 30 acres of parks within its boundaries.

Other recreational pursuits in the Scottsbluff area include fishing. The North Platte River, Nine Mile Creek, and Red Willow Creek support natural rainbow and brown trout populations.

P. POPULATION PROJECTIONS AND ECONOMIC FORECASTS

1. Population

a. Scotts Bluff County

The 1974 population of Scotts Bluff County was 35,200 (University of Nebraska, No Date). This represented a 4.1 percent increase from the 1960 population and a 3.4 percent decrease from the 1970 population. The 1960 to 1970 increase was 7.8 percent, which has been partially reversed by more recent trends.

County population is projected to increase to 43,618 by 2000. (University of Nebraska, No Date). This rate of increase is less than predicted in earlier projections by the Scottsbluff County Planning Commission (Scotts Bluff County, Nebraska - Comprehensive Plan, 1970). The Comprehensive Plan cited year 1990 projections for the County, Scottsbluff, Gering and Terrytown which were noted to be maximum projections made by the plan consultants, Robert J. Selander and Associates and M. C. Schaff and Associates. In order to reach the medium population of 43,618 by 2000, the county will have to grow at a faster rate (324 persons/year) for the rest of the century than it did during the rapid growth period of 1960-1970 (262 persons/year).

b. Scottsbluff, Gering and Terrytown

Census data for 1960 and 1970 show that all of the net growth occurring in Scotts Bluff County took place in the three municipalities of the study area. The extent to which this growth is due to annexation has not been investigated. Population outside the municipalities declined by 146 during the decade. Average annual population increases for the municipalities were 113 per year in Scottsbluff, 105 per year in Gering, and 58 per year in Terrytown.

In April, 1976, a special census was conducted in Gering. The 1970-1976 population increase of 1,041 to 6,680 is equivalent to an average annual increase of 173 per year, indicating continued strong growth in urban areas of the county even while the county population as a whole has stabilized or is declining.

Recent and projected populations of Scotts Bluff County and the three municipalities in the Primary Study Area are presented in Table II-21. In order to reach the year 2000 design population for the three municipalities of 31,950, this urban area will have to realize net average gains of 368

Table II-21

Population Projections for Scotts Bluff County
and Municipalities within the Primary Study Area

Area	1960 ^a	1970 ^a	1974 ^b	1976	1980	1990	1995	2000
Scotts Bluff County	33,809	36,432	35,200 ^b		39,235 ^c	43,500 ^d 41,934 ^c		43,618 ^c
County except Scottsbluff, Gering and Terrytown	15,683	15,539				17,080 ^d		11,668 ⁱ
Scottsbluff	13,377	14,507				18,050 ^d	19,200 ^f	19,800 ^g
Gering	4,585	5,639		6,680 ^e		7,630 ^d		9,700 ^h
Terrytown	164	747				740 ^d		2,450 ^h
Total for Municipalities in Primary Study Area	18,126	20,893				26,420 ^d		31,950

^a Census Data.

^b U.S. Bureau of the Census, Census of Population and Current Population Reports Series. P-26.

^c University of Nebraska, Bureau of Business Research, Nebraska Population Projections.

^d Projections reported in the Scotts Bluff County, Nebraska - Comprehensive Plan, 1970 and cited in the Scottsbluff Facilities Plan

^e Special Census data for Gering.

^f Design population used in the Scottsbluff facilities plan.

^g Straight-line projection of "F" to year 2000.

^h Design populations used in preliminary drafts of the Gering and Terrytown Facilities Plans

ⁱ By difference between Univ. of Nebraska county projection and Bell, Galyardt and Wells' design populations.

persons per year (1970 to year 2000). This figure seems optimistic compared to the area gain in the 1960's of 277 persons per year. However, if the 1960-1970 percent increase of about 15 percent is applied as a 10-year compound rate of increase using 1970 census data as the base, the Facilities Plans' design population for the urban area would be reached. The difference between a straight line projection to year 2000 for the urban area (29,203 persons) and the compounded percent increase (31,995 persons) is 2,792. The Facilities Plans' urban area design population of 31,950 is considered as an upper limit, but within the limits of our ability to make projections for small populations.

2. Economics

a. Employment

Total employment in Scotts Bluff County has been increasing rapidly. Between 1960 and 1970 employment increased 18 percent in the County compared to six percent in the state. In 1974 the total work force was near complete employment with an unemployment rate of 3.2 percent (Nebraska Department of Economic Development, 1976).

Jobs in manufacturing, wholesale and retail trade, and services in Scotts Bluff County are increasing, while those in agriculture are decreasing, as a comparison of 1960 and 1970 statistics illustrates in Figure II-13. Agricultural employment had decreased even more to 11 percent in 1975. The number of farms has been declining at an average annual rate of -2.4 percent between 1960 and 1974, with a total of 1,140 in 1976 (Nebraska Public Power District, 1976). This change in number of farms most likely is the result of consolidation, not of reduced production.

The Cities of Scottsbluff and Gering constitute the largest population, industrial, and retail center in the Nebraska Panhandle. The retail trade area for Scottsbluff and Gering is shown in Figure II-14. Manufacturing employment for the county is centered in these cities, with major employers

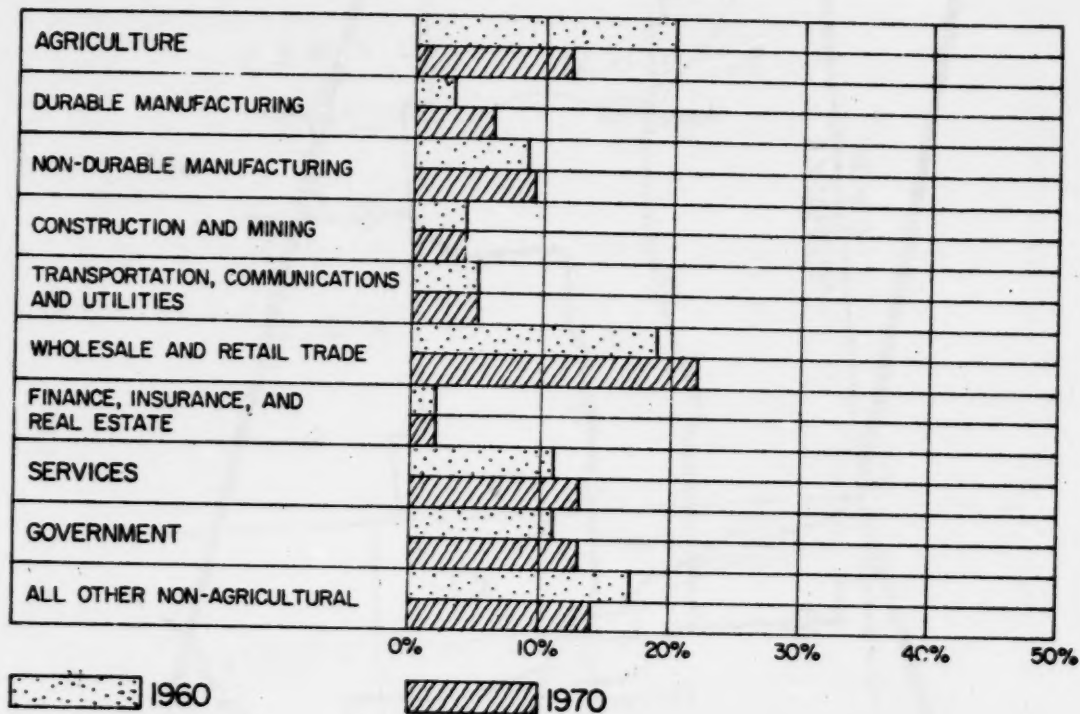


Figure II-13.

DISTRIBUTION OF EMPLOYMENT BY MAJOR INDUSTRY GROUP,
SCOTTS BLUFF COUNTY, 1960 AND 1970

Source: Neb. Dept. Econ. Dev., Res. Div. 1972. Economic growth performance study. Prepared by Neb. Dept. Roads. p. 4.



Figure II-14.

SCOTTSBLUFF RETAIL TRADE AREA

Source: Neb. Dept. Econ. Dev., Res. Div. 1972. Economic growth performance study. Prepared for Neb. Dept. Roads. p. 2.

being Lockwood Corporation, Nebraska Mobile Home Manufacturing Corporation, Great Western Sugar, Swift and Company, B&L Steel Corporation, CRA Inc., and Flanery Foods, Inc. There are no major manufacturing firms in Terrytown. A complete list of manufacturers for Scottsbluff and Gering is included in Appendix H along with other relevant economic data for Scotts Bluff County.

Data collected in the 1970 U.S. Census show that the percentage of population living at or below poverty level was 13.6 percent in the City of Scottsbluff, and 11.5 percent in the City of Gering. Similar statistics are not reported in the 1970 Census for Terrytown. At present the national poverty level for a family of five is \$6,810 income per year for non-farm families.

Persons over 60 years of age are assumed to be on fixed income. They represented 16.8 percent of the Scottsbluff and 14.9 percent of the Gering populations in the 1970 Census. Again, similar statistics were not reported for Terrytown.

Q. ARCHAEOLOGICAL AND HISTORICAL RESOURCES

1. Archaeology

The North Platte Valley has been a human migration corridor for centuries. Stone artifacts found in the area date back over 10,000 years. Prehistoric cultural complexes inhabiting the plains area prior to 5000 B.C. are known as the "Eastern Fluted Point Hunters". These people hunted the mammoth and extinct forms of bison. By 4000 B.C. these early big game hunters had developed regionally distinct groups who lived by game hunting, fishing and wild plant gathering. They are identified today by distinct projectile point forms and are known as the Archaic peoples. During the 500 B.C. -A.D. 500 period, maize agriculture and settled village life began to develop. Bison hunting continued to be a major factor in the culture. Between A.D. 500 - 1300 this culture flourished, and is now seen to be directly ancestral

to known and named tribal groups encountered by the Europeans who arrived in the 16th and 17th centuries. The tribal groups included the Arapahoe, Brule, Oglala, and Cheyenne.

In conjunction with preparation of two separate environmental assessments of the North Site and the South Site proposed for wastewater irrigation facilities for the City of Scottsbluff, Nebraska, the firm of Bell, Galyardt and Wells, Inc. requested an archaeological survey and report for each site. A pedestrian archaeological survey was conducted of the force main corridor and holding pond site for the proposed north wastewater irrigation facility; an intensive literature review of historic and prehistoric reference materials was conducted for the force main route and holding pond site for the proposed south wastewater irrigation facility.

During August 1976, a pedestrian archaeological survey of the rerouted force main and proposed site of the holding pond for the north wastewater facility was conducted under the direction of Dr. Larry D. Agenbroad, Chadron State College, Chadron, Nebraska. In his report to Bell, Galyardt, and Wells, Inc., Dr. Agenbroad explained that the force main rights-of-way and holding pond area were "walked and searched for archaeological or historical artifacts or sites of importance." The report did not include discussion of the suitability of the proposed wastewater facility site for prehistoric or historic occupation and the nature and extent of previous disturbances to the ground surface, or indicate the likelihood that deeply buried remains might occur on the project site. It indicated two waste flakes and a broken projectile point (type unspecified) were found in a blowout southeast of the windmill in Section 23. A historical marker was present in the northwest quarter of Section 32, R54W, T22n.

During January 1976 a thorough literature review of the proposed south

irrigation site for Scottsbluff was conducted under the direction of Dr. Carl R. Falk of the University of Nebraska, Lincoln, Nebraska. Dr. Falk's report included a summary statement of the culture history of the Scottsbluff area relevant to the proposed project, an assessment of the potential impact of the proposed irrigation development on known cultural resources, and an assessment of potential project impact on unknown resources, together with recommendations for subsequent investigation. The project area investigated by Dr. Falk included seven miles of force main, a planned storage pond site, and proposed irrigation sites. No field reconnaissance was included in the study prepared by Dr. Falk.

Evidence from archaeological research in other sections of western Nebraska cited by Dr. Falk indicated that there is a possibility that pre-historic remains exist on the floodplain bordering the North Platte River, on low terraces adjacent to the floodplain, on small bluffs south of the river, and on blocks of gently sloping acreage which rises to more than 200 feet above the valley floor. The report also concluded that there was substantial activity in the Platte River valley during historic times, and that remains of this activity may occur on the surface or below the surface of the project site (South Site).

The following are Dr. Falk's conclusions:

- "1. Archaeological research in the immediate Scottsbluff area has been minimal. From an archaeological point of view the area is poorly known.
- "2. Previous archaeological and historical research has documented occupation and utilization of the general area over the past 12,000 years.
- "3. Archaeological and historical investigations have documented

use of the immediate Scottsbluff area for at least the past two millennia."

- "4. Our investigation has suggested that no known prehistoric sites will be affected by proposed irrigation development; data are insufficient to adequately evaluate potential impact on various historic American trails which cross the proposed pipeline right-of-way, though no known sites will be affected.
- "5. Review of the available evidence suggests that unknown sites (e.g., buried occupants) representative of one or more cultural periods may be affected by the proposed project. This proposition can only be refuted through actual on-site survey and evaluation. Similarly, the potential for discovery of unknown historic resources through field survey cannot be discounted."

The Nebraska State Historic Preservation Officer, in a letter dated September 6, 1977, and reproduced here in Appendix R, cleared the North and South Sites for uses as previously proposed in Scottsbluff Facilities Planning documents. As no historic or archaeologic investigations have been performed for the new areas (North Valley Irrigation Area, South Valley Irrigation Area, and Valley Complete Retention Area) considered in this EIS, implementation of any alternatives using these sites would require prior consultation with the Nebraska State Historic Preservation Officer.

2. History

The county and city of Scottsbluff are named for the prominent bluff in the area, which is a noted landmark. Early pioneers named the bluff for Hiram Scott, an early traveler and mountaineer, around 1838. The area was

traversed by a number of trails used by settlers of the west, including the Mormon, Oregon, California, and Black Hills Trails. Pioneers and railroad workers were protected by a number of forts which were constructed in the Scottsbluff area.

Gering was settled in 1887, followed by Scottsbluff in 1900. The irrigation system, essential to the development of agriculture in the area, was begun in 1904.

The National Historic Register lists three sites in Scottsbluff County. They are: 1) Roubadeau Pass, located eight miles southwest of Gering; 2) Signal Butte, 12 miles west and 2 miles south of Gering; and 3) Scottsbluff National Monument, which is three miles west of Gering.

Sites of state historical significance in the secondary study area are as follows:

Ficklin's Springs Pony Express Station -- located near Highway 92 one mile west of Melbeta. Built as a Pony Express station, it was later a telegraph station and in 1865 was occupied by U.S. troops who fortified it. In 1871 the sod structure became part of M. E. Coad's open range cattle operations.

Gering Burials (25SF10) -- these burials are generally considered Woodland but are associated with atlatl weights, which suggest late archaic influence, Prehistoric Aboriginal.

Fort John -- located in Helvas Canyon nine miles southwest of Gering. It was a trading post of the American Fur Company established in 1850 and operated by Major Andrew Drips. During the early 1850's it was the most important trading post in western Nebraska.

Site 25SF11 -- on the west edge of the summit of Scotts Bluff; this site appears to be a chipping station, Prehistoric Aboriginal.

R. AESTHETICS

1. General

The Scottsbluff-Gering-Terrytown community is located on the scenic North Platte River in the Nebraska Panhandle. The area is characterized by large bluffs, rugged hills, and large tracts of flat, open rangeland.

Visually, the existing Scottsbluff and Gering treatment plants present a low profile on the landscape. Terrytown's plant is entirely above ground, but is surrounded by flood control dikes and is generally organized in appearance.

S. ODOR AND NOISE

The existing wastewater treatment facilities in Scottsbluff, Gering, and Terrytown have not been the source of complaints about nuisance odor or noise conditions. The potential for external noise problems exists only in Terrytown, where residences are located in close proximity to the existing plant. The potential for odor problems exists at all three plants: in Terrytown because of the plant's proximity to residences and a major transportation route (Route 71); in Scottsbluff because of the lagoon's proximity to a major transportation route (U.S. Route 26) and the possibility of odor release after spring melting of ice cover; and in Gering because of its proximity to proposed FAS-28 County Road crossing the North Platte and spring ice melt.

T. ENVIRONMENTALLY SENSITIVE AREAS

Environmentally sensitive areas are land or water areas which are unique or uncommon and can include natural or man-made physical features. Sensitive areas may also include biological communities, populations, or species which

can be damaged either permanently or temporarily by direct or indirect actions resulting from project implementation.

Based upon the available literature as augmented by site visits, a list of environmentally sensitive areas has been compiled. Areas which are within the primary and secondary study areas are listed as being either individual sites or of general or unknown occurrence. Capsule descriptions are also given for each site or area.

1. North Platte River

The North Platte is the primary watercourse in the Scottsbluff County area. It is the source of nearly all of the irrigation water used in the Valley, and is the receptacle for major wastewater discharges. The North Platte provides habitat for numerous fish species, including rainbow and brown trout, and provides potential recreational benefits. Sedimentation and lack of access limit recreational use and aesthetic value of the river.

2. Scotts Bluff National Monument

An 800-foot-high bluff near the North Platte River, this geologic structure was designated a National Monument because of its significance in the settlement of the areas west of Nebraska. The bluff was a landmark to Indians, trappers, and settlers. Trails to the west went through Mitchell Pass, in the bluff, and are still visible in the Monument. It is a historic and geologic resource and has considerable aesthetic value.

3. Wildcat Hills

The Wildcat Hills area, which begins in the southernmost part of the study area eight miles south of Scottsbluff, represents some of the most scenic land in the Scottsbluff area. An abundance of wildlife is found in these hills, including elk and buffalo, which are kept in an enclosure on

the south side of the hills near the Scottsbluff county line. The area is maintained as a game reserve by the State of Nebraska, and several unique species, including golden eagles and bobcat, inhabit the area.

4. North Platte National Wildlife Refuge

This area consists of Lake Alice, Lake Alice No. 2, Winters Creek Lake, and Lake Minatare, all irrigation control lakes in the northern part of the study area. This is a multiple use area including boating, fishing, camping, second home type development. Migratory waterfowl make extensive use of these lakes.

5. Tub Springs Creek

This creek is known to support a viable trout population, as do many of the tributaries of the North Platte River in the Scottsbluff area. Trout migrate from Lake McConaughy to the south to these tributaries for spawning purposes. This stream also supports other fish populations, but trout habitat is considered to be most sensitive.

6. Winters Creek

This tributary of the North Platte River also serves as a spawning area for trout. It is subject to periodic stress by water withdrawals in connection with sugar beet processing.

7. Agricultural Lands

Agriculture in the North Platte Valley is the major land use, and is an important economic factor in the county. Land suitable for row crop agriculture is limited to the valley by the availability of irrigation water.

8. Irrigation Canals

Several irrigation canals traverse the study area distributing water

throughout the Valley. An uninterrupted supply of irrigation water during the growing season is necessary to maintain agricultural systems in the area.

9. Archaeological and Historic Sites

The North Platte River Valley is an area of archaeological value. The valley is made up of several terraces formed by erosion of tributary streams and the North Platte River itself. On the second terrace nearest the river, 10,000-year-old flint points similar to others found in western Nebraska have been found. The first terrace next to the river has yielded hearths, pottery shards, and flint points in abundance. Several archaeological and historic sites are located in the primary and secondary study areas.

10. Bluffs

The bluffs bordering the Valley are sensitive due to the high potential for wind erosion in disturbed areas. Steep slopes are found throughout the bluff areas.

11. Groundwater Resources

The domestic water supply for the entire study area is groundwater. Groundwater quality must be protected. No recent comprehensive groundwater quality data exists for use as baseline information. Groundwater movement in the upland areas of the county is toward the North Platte River. In the Valley area, groundwater movement is parallel to the direction of the North Platte River flow.

CHAPTER III

ALTERNATIVE DEVELOPMENT AND SCREENING

A. INTRODUCTION

The development of alternatives described in this report begins with the identification of functional components within the wastewater treatment system. The functional components considered here are:

- Flow and Waste Reduction - includes industrial pretreatment, Infiltration/Inflow rehabilitation, and water conservation measures.
- Collection System - includes service area configurations and interceptor sewer routing.
- Treatment Plant Siting - includes siting of wastewater and sludge processing facilities but not effluent or sludge disposal sites.
- Wastewater Treatment Processes - includes biological and/or physical unit processes for treating wastewater to the desired effluent quality.
- Effluent Disposal - includes available means for discharge, land application or reuse of adequately treated wastewater
- Sludge Treatment and Disposal - includes processes for stabilization, conditioning, dewatering, volume reduction and disposal of wastewater treatment residues.

The methods considered for fulfilling the functions of each of these six system components can be termed "component options" or, simply, "options".

The alternatives were developed so that options are matched to be functionally compatible and to achieve environmental goals to the maximum degree possible.

Appropriate component options are discussed as necessary to qualify their inclusion in system-wide alternatives. The dependence of one option in a component on options in other components is noted where they are the basis for development of specific system-wide alternatives. A single best option for a component is identified if it is functionally compatible with highly feasible options for other components. Complete system alternatives for each of the three municipalities in the study area were selected by combining feasible component options, and were developed so that options are matched to be functionally compatible.

The proximity of the three existing wastewater treatment plants and possible economies of scale suggest that regional solutions for wastewater management may be attractive. Consolidation of treatment and disposal facilities generally reduces new construction costs per unit of flow, reduces the total manpower required to operate and maintain the facilities, and facilitates more vigorous monitoring and control of treatment and disposal processes. Two of the six components applicable to development of system components are not applicable to development of regional solutions in this study area. While they are considered in the design and the cost-effectiveness of regional solutions, the collection system and flow and waste reduction components are not, by themselves, the basis for development of regional solutions. System alternatives and regionalization alternatives found feasible were evaluated on the basis of environmental impacts, costs, reliability, and resource use.

The design wastewater flows and loads of BOD and suspended solids used in alternatives are tabulated for Scottsbluff, Gering, and Terrytown in Table III-1. The effects of various technologically feasible options for meat

Table III-1

Summary of Projected Waste Flows and Loads

Waste	Flow MGD	Industrial Pretreatment Options for Meat Packing Plants							
		No Pretreatment		Screening		Screening + DAF**		Max. Pretreatment**	
		BOD	TSS	BOD	TSS	BOD	TSS	BOD	TSS
		lbs/day	lbs/day	lbs/day	lbs/day	lbs/day	lbs/day	lbs/day	lbs/day
<u>SCOTTSBLUFF</u>									
Domestic ¹	1.98	3400	4000	3400	4000	3400	4000	3400	4000
Flanery Foods ⁴	0.40	4520	5080	3850	3050	3080	1780	450	460
Infiltration	0.55	0	0	0	0	0	0	0	0
Future Industries	0.10	500	500	500	500	500	500	500	500
CRA ⁶	0.19	40	30	40	30	40	30	40	30
Total	3.22	8460	9610	7790	7580	7020	6310	4390	4990
<u>GERING</u>									
Domestic ²	1.16	1750	1940	1750	1940	1750	1940	1750	1940
Stanko & Swift ⁵	0.78	9410	11810	8000	7090	6400	4130	940	1060
Lockwood ⁷	0.18	270	290	270	290	270	290	270	290
Future Industries	0.26	500	500	500	500	500	500	500	500
Total	2.38	11930	14540	10520	9820	8920	6860	3460	3790

¹ Scottsbluff year 2000 design population - 19,800.

² Gering year 2000 design population - 9,700.

³ Terrytown year 2000 design population - 2,450.

⁴ Based on 400,000 lb/day Live Weight Kill as described in Section III.B.1.

⁵ Based on combined 780,000 lb/day Live Weight Kill as described in Section III.B.1.

⁶ CRA - see Section III.B.1.

⁷ Lockwood - see Section III.B.1.

*Dissolved air flotation

**Fine screening + DAF and anaerobic/aerated lagoons

packing plants on these design parameters are also presented, since pre-treatment critically affects the feasibility of various wastewater treatment options. The projections presented in Table III-1 differ from projections in the Facilities Plans in two respects:

- The 1995 population projection for Scottsbluff Facilities Plan was linearly extrapolated to a year 2000 population of 19,800, since the design year for the planned facilities must be the same for all three municipal systems in order to form a basis for valid comparisons.
- Industrial waste flow and load projections for the three major meat packing plants in the study area have been revised to reflect readily obtainable reductions in non-process wastewater discharges (Flanery Foods, Inc., Stanko Co., and Swift & Co.) and maximum BOD and suspended solids loads based on full capacity of plants' cold storage facilities.

B. COMPONENT OPTIONS

1. Flow and Waste Reduction Options

Measures to reduce the sewage flows or pollutant loads prior to treatment generally fall into three categories: industrial pretreatment, water conservation measures, and infiltration/inflow rehabilitation.

a. Industrial Pretreatment and Water Conservation Measures

Industries located in the Cities of Gering and Scottsbluff contribute significant proportions of the wastewater flows and loads presently treated in each city's lagoon systems. Because of their significance to the design and selection of wastewater system alternatives, the major water-using industries in these cities were visited and key personnel were interviewed

with the purpose of acquiring information useful in estimating present and future wastewater flows and loads. This information is discussed in Appendix G and summarized here by industry.

Flanery Foods, Inc. -- This meat packing plant is located in Scottsbluff and slaughters beef with 70 percent shipped as carcass and 30 percent as deboned meat. Included in its facilities is a continuous dry-process rendering plant. In the absence of a formal commitment on future wastewater flows and loads from Flanery Foods, Inc., it has been assumed for purposes of alternative development that industry will want a reserve equivalent to their waste output at full production rate. Flanery's full production rate is estimated to be 400,000 pounds Live Weight Kill (LWK) per day. As in other meat packing plants, production rate is primarily limited to cooler capacity. Projected waste loads and flows for Flanery Foods, Inc., are listed in Table III-2 below:

Table III-2

PRESENT AND (PROJECTED) WASTE LOADS FOR FLANERY FOODS, INC.

	<u>BOD₅</u>	<u>Suspended Solids</u>	<u>Oil and Grease</u>	<u>Total Kjeldahl Nitrogen</u>
mg/l	1053	1210	547	50
lbs/day	3732 (4524)	4190 (5080)	1993 (2416)	183 (222)
lbs/100 LWK	11.2	12.7	6.2	0.6
	<u>gal./1000 lb LWK</u>		<u>mgd</u>	
Present Flow	1285		.385	
Projected Flow	(1000)		(.400)	

The projected flow assumes a moderate reduction of 22 percent in process water usage per unit kill with low capital additional clean water segregation

and improved housekeeping and maintenance. Wastewater from this plant enters the sanitary sewers of Scottsbluff.

Swift and Co. -- This meat packing plant, the largest in the area, is located in Gering and slaughters beef and lamb for shipment as carcasses only. Facilities include a batch type dry-rendering plant. The plant has been operating at or near full capacity, and averaged 530,000 pounds LWK per day during 12 months in 1975-76. Swift and Co. has announced the closing of its operation in Gering. It has been assumed here for purposes of alternative development that the plant will not remain idle permanently. Waste flow and load projections presented in Table III-3 are for operation at full production rates (production during the four-day sampling program reported in the Gering Facilities Plan averaged 442,000 lb/day LWK, or 83% of capacity) and assume that non-process cooling waters will be removed from the industrial sewer, resulting in a 36 percent reduction in the present rate of process water consumption. Swift's wastewaters are conducted to Gering's industrial wastewater treatment lagoons in a segregated industrial sewer along with wastewater from Stanko Packing Company, Inc.

Table III-3

PRESENT AND (PROJECTED) WASTE LOADS FOR SWIFT & CO.

	<u>BOD₅</u>	<u>Suspended Solids</u>	<u>Oil and Grease</u>	<u>Total Kjeldahl Nitrogen</u>
mg/l	1085	1560	250	72
lbs/day	5430 (6516)	7470 (8964)	1280 (1536)	355 (426)
lbs/100 LWK	12.29	16.9	2.9	0.8
	<u>gal./1000 lb LWK</u>		<u>mgd</u>	
Present Flow	1552		.69	
Projected Flow	(1000)		(.53)	

Stanko Packing Co., Inc. -- This meat packing plant is located in Gering and slaughters only beef for complete deboning. The plant includes no rendering facilities. As for the other major meat packing plants, wasteloads expected at full production rates are used in alternative development. Stanko management personnel project an increase to 250,000 lb/day LWK. Production during the sampling program for the Gering Facilities Plan was 189,000 lb/day LWK. As with Swift and Co., a substantial flow reduction through segregation of clean-water flows is feasible and is assumed in these projections. This water can be separated and discharged separately or recycled to freshwater storage tanks.

Table III-4

PRESENT AND (PROJECTED) WASTE LOADS AND FLOWS FOR STANKO PACKING CO., INC.

	<u>BOD₅</u>	<u>Suspended Solids</u>	<u>Oil and Grease</u>	<u>Total Kjeldahl Nitrogen</u>
mg/l	980	960	128	80
lbs/day	2190 (2897)	2150 (2844)	290 (384)	180 (238)
lbs/100 LWK	11.6	11.4	1.5	.95
	<u>gal./1000 lb LWK</u>		<u>mgd</u>	
Present Flow	1428		.27	
Projected Flow	(1000)		(.25)	

Reduction for Waste Loads in Meat Packing Plant Wastewaters -- The meat packing plant wastewaters in Gering and Scottsbluff represent substantial portions of present and projected organic wastes loads and nearly all of the oil and grease disposed of in the municipal facilities. Reduction of these waste loads by in-plant process modifications and by various wastewater treatment methods is technically and economically feasible. Since the design

of municipal treatment facilities is based in part on projected waste loads, reductions in industrial loads could reduce the public costs for wastewater treatment.

In order to evaluate the effects of industrial waste load reductions on municipal facilities design and cost, a range of feasible reductions was considered in preliminary design of the municipal facilities. The percentage reductions in BOD, suspended solids and oil and grease achievable using combinations of three accepted wastewater treatment processes (fine screening, dissolved air flotation, and anaerobic/aerobic lagoon treatment) are presented in Table III-5.

Table III-5

Percent Reductions of Organic Constituents in Meat Packing
Wastewater by Wastewater Treatment Processes

Treatment Process	Percent Reductions		
	BOD	Suspended Solids	Oil and Grease
Fine Screening	15	40	50
Fine Screening and Dissolved Air Flotation (DAF)	32	65	84
Fine Screening, DAF and Anaerobic/Aerated Lagoons	90	91	97

Sources: Environmental Protection Agency, Technology Transfer, "In-Plant Modifications and Pretreatment: Upgrading Meat Packing Facilities to Reduce Pollution" and "Waste Treatment: Upgrading Meat Packing Facilities to Reduce Pollution" October, 1973.

Fine screening alone was found to have little impact on design of municipal waste treatment facilities due to its comparatively low BOD removal efficiency. The other two combinations were selected to demonstrate the range of feasible

load reductions and to provide the basis for evaluating the sensitivity of municipal facility design and costs to assumptions about industrial pretreatment. It is emphasized that these load reductions could be achieved by the meat packing companies by other means, including both process modifications and other types of wastewater treatment.

CRA, Inc. -- The wastewater from production processes is treated at the plant by natural gas stripping (of catalytic cracking process wastewater), API separator, aerated lagoons, and aerobic lagoons. Prior to October 1976, the treated process wastes were discharged to the North Platte. Since then, Scottsbluff has accepted the treated wastewaters in its sanitary sewer system. It is assumed here that CRA, Inc., will continue to operate and maintain its wastewater treatment facilities, and that 1976 average concentrations of the following constituents will be maintained at a flow rate of .19 mgd:

BOD	25 mg/l
Suspended Solids	19 mg/l
Oil and Grease	17 mg/l
Phenols	4 mg/l
Ammonia	512 mg/l

Sampling during 1970-71 for chromates and zinc showed concentrations to be below a detection limit of 0.1 mg/l.

Lockwood Corporation -- Manufacturing processes used at this plant south of Gering include galvanizing, painting, chain manufacturing, and machine shop and welding operations. The plant's wastewater was sampled on October 21, 1977, and analyzed for heavy metals and oils which could be wasted from the manufacturing processes. The primary pollutant of concern is zinc (measured at 30.9 mg/l) from galvanizing (which will be discontinued at the plant within two years and

chain manufacturing. Concentrations of zinc and other heavy metals in Gering's wastewater treatment plant effluent, as sampled by Bell, Galyardt, and Wells, were all below detection limits. Lockwood's current water consumption rate of .177 mgd is used as an estimate of their wastewater flow.

b. Infiltration/Inflow Rehabilitation

The I/I analyses for Scottsbluff, Gering, and Terrytown are discussed in Appendix I. Assumptions made in preparing the I/I analyses appear to have resulted in an underestimation of infiltration in Scottsbluff and Gering. Based upon considerations reviewed in that Appendix, systematic sewer rehabilitation efforts do not appear to be justified on the basis of cost-effectiveness.

Removal of infiltration sources from the study area's three sewage collection systems is not necessarily desirable for all treatment and disposal options considered here. Resulting reduction in flow would improve both detention times and storage (no discharge) times for any alternative which includes continued use of the existing aerobic lagoons in Gering and Scottsbluff. For instance, at design (2000) flows in Scottsbluff, removal of 70% of infiltration (assuming .55 mgd total infiltration) would increase both detention and storage time in the existing lagoon system from 38 to 43 days. Reductions in land required for complete retention of wastewaters would also be a favorable result of infiltration rehabilitation. However, since the clear-water flow probably dilutes the total dissolved solids content of these wastewaters, alternatives including effluent disposal by land application would have to incorporate higher leaching rates and hydraulic loading rates because of higher solids concentrations resulting from removal of infiltration. Additionally, the increase in concentration of dissolved solids will be accompanied by an increase in the Sodium Adsorption Ratios of the

irrigation waters, since in the SAR formula, SAR increases linearly with sodium concentration, but as the inverse square root of calcium and magnesium concentrations.

2. Collection System Options

With the exception of rerouting the sewer serving the Scottsbluff Municipal Airport, there are no proposals for construction of new collection sewers in the area. Force mains and pumping stations are discussed in the appropriate treatment, disposal, and regionalization alternatives descriptions.

The future configuration of the airport sewer would be linked to options for treatment and effluent disposal. Possibly due to infiltration in the airport sewer, the concentrations of BOD₅ (22.5 mg/l) and suspended solids (35.8 mg/l) are low, and so would not require full treatment. In particular, for system alternatives including effluent disposal by complete retention or land application, the present sewer configuration with pumping of the airport flow to Lagoon #5 would be sufficient. The organic load from the airport sewer is 7.5 lbs BOD/day, and would increase the loading rate for Lagoon #5 by only .33 lbs/acre/day.

Community hygiene problems associated with inadequate on-lot residential sewage disposal systems in the primary study area have been noted by local public health officials (Personal Communication, Messrs. Schliffe and Taylor, October, 1976). It is reported that most of these will hook up to the municipal sewerage systems. Funds to accomplish this have not been applied for in Construction Grant applications.

3. Treatment Plant and Disposal Siting Options

a. Treatment Plant Sites

Considerable public funds have been previously committed to acquisition and development of the lagoon systems in Scottsbluff and Gering. The locations

of these facilities are shown in Figure I-4. Because of these prior land and monetary commitments, economic and land disruption considerations weigh heavily in favor of retaining these sites and facilities when evaluating treatment plant siting options for these cities. Adverse impacts associated with continued use of the existing lagoon systems would be continued potential odor problems and continued encroachment on the floodplain of the North Platte River. Potential odor problems will be minimized by limiting BOD loading of the lagoons to low levels. Gering's lagoons encroach on the floodplain slightly, but cause only a minimal reduction in the 100-year flood cross-sectional area. The Scottsbluff lagoons are, however, a significant encroachment on the floodplain. To reverse this encroachment, the lagoons could be abandoned and regraded to original contours in conjunction with construction of a new, less land-consumptive treatment plant on the site, located out of the floodplain as much as possible.

The siting decision to be made in Terrytown is whether to continue using the existing activated sludge treatment plant or to retain only the pumping station for transporting Terrytown's wastewater to the Gering site or to the Scottsbluff site. This choice will be addressed in the discussion of regionalization alternatives in Section III.D.

Several of the treatment options for Gering and Scottsbluff discussed in Section III.B.4 require the commitment of additional land for new treatment units such as aeration basins, new stabilization lagoons (Gering only), effluent clarification facilities and sludge processing units. In the absence of detailed siting analysis, it is simply assumed here that suitable acreages are or will be available at prices comparable with present agricultural land prices in the primary study area. Sites are also assumed to be in close proximity to existing facilities to minimize wastewater transport costs.

b. Agricultural Irrigation Sites

Prior to the preparation of this EIS, two sites, referred to as the North and South Sites, were considered for use in locating storage ponds and agricultural irrigation acreage. The sites were considered despite their distance from, and their considerable elevation above, the existing lagoon systems, for the following reasons:

- increases in agricultural productivity from converting range (North Site) and dry-farmed land (South Site) to irrigated farmland.
- noninterference with existing irrigation distribution systems
- low population and groundwater well densities

Both sites are situated above the highest irrigation canals on either side of the valley. Both sites have large acreages of soils suitable for agricultural irrigation with treated wastewaters, although thin soils and steep slopes are present in small areas on each site.

In order to compare the costs and environmental impacts of irrigation at these sites to irrigation at sites closer to existing sewage treatment plants, soil maps were examined (Yost and others, 1968) to locate suitable soils that were closest to Gering's and Scottsbluff's lagoon systems. Generalized areas meeting these conditions are located in Figure I-3 and are labeled "Potential Valley Irrigation Areas". These areas are identified for comparison purposes -- no specific sites have been selected. Whereas the North and South sites would have to be irrigated by center pivot or similar equipment because of topography, suitable acreage in the potential valley irrigation areas is nearly all irrigated by ridge and furrow techniques and could continue to be irrigated by this method if treated wastewater is used.

c. Complete Retention Sites

The Scottsbluff and Gering Facilities Plans considered only the North and South sites for locating the new ponds that would be required for complete retention. Based upon testimony given at the 23 February, 1976 public hearing on wastewater irrigation for Scottsbluff at the South site, it appears that complete retention was visualized as a back-up to agricultural irrigation should irrigation with wastewater prove unfeasible after being tried. As suggested by a private citizen participating in that public hearing, an area close to the Scottsbluff lagoon is considered here for locating complete retention ponds that would be used in conjunction with Gering's and/or Scottsbluff's existing lagoons. Soils in this area, identified in Figure I-3, are of the Minatare and Janice soil series. They are highly alkaline and saline, have a high water table and are agriculturally suited only for permanent pasture. They are underlain at shallow depths (3 to 6 feet) by sand and gravel deposits of Pleistocene and Recent age.

4. Wastewater Treatment Process Options

a. Scottsbluff

The level of treatment, and, therefore, the treatment units required in Scottsbluff are principally determined by two variables: industrial pretreatment options for Flanery Foods, Inc., and effluent disposal options including stream discharge, agricultural irrigation and complete retention. Conceptual design considerations for new or upgraded existing treatment units incorporating the variations in waste loads resulting from pretreatment assumptions for Flanery Foods' wastes are discussed here by effluent disposal option:

Wastewater Treatment Processes for Complete Retention -- Since there would be no effluent discharge to surface waters or to agricultural land

under this option, no new treatment units would be required. Primary considerations in the conceptual design of a complete retention alternative for Scottsbluff's wastewaters are, therefore, avoidance of nuisance problems from organic overloading of individual lagoon cells and prevention of ground water contamination from percolation of the wastewaters. These considerations are discussed in conjunction with "Effluent Disposal Options", Section III.5.

Wastewater Treatment Processes for Land Application -- The effluent quality required for land application options in terms of organic content (BOD and suspended solids) is not as critical as with stream discharge options. Long detention times in the existing treatment lagoon and in storage lagoons near the application site will allow for sufficient oxidation of organic materials prior to land application. Therefore, additional treatment units at the existing lagoon site would be necessary only to prevent nuisance conditions and to disinfect the lagoon effluent prior to storage.

The land application alternative proposed in the August, 1975 Scottsbluff Facilities Plan considered restructuring the first lagoon cell to provide an 11.5 acre aerated lagoon which was estimated to provide a 75 percent reduction in BOD. Effluent from the aerated lagoon would be distributed among the remaining five lagoon cells to reduce BOD and suspended solids further. Rerouting of the distribution pipes to these lagoons would be required in order to evenly distribute the remaining BOD load. Otherwise the pond configurations and effluent routing could remain the same as proposed in the Scottsbluff Facilities Plan - Figure 7a.

Consideration of the public health aspects of spray irrigation (See Section III.E.11.) argue for disinfecting the collected lagoon effluents

prior to irrigation. It is recommended that chlorination capability be included in the treatment processes at the existing lagoon site. The alternative would be to have these facilities at the storage pond site. Ease of operation at the existing lagoon site, as well as possible toxic effects of free available and combined chlorine residuals in the irrigation (post-storage) water, support chlorination facilities siting at the existing lagoons.

Operation of the lagoons during non-irrigation months (October through April) will take advantage of the 310 acre-feet of storage volume in the five remaining lagoons between the two and five foot operating depths as proposed in the Facilities Plan. This will provide a considerable savings in the acreage for the storage pond. Lagoon depth would be lowered to two feet in October and allowed to increase to five feet in April. Increasing the heights of the lagoon dikes will also be incorporated into alterations of the lagoon system as proposed in the Facilities Plan.

Siting considerations for lagoon improvements are limited to location of the chlorination facilities since adequate space for other treatment units is already provided for. Because adequate detention time and mixing would be provided in even the shortest force main considered here (one mile) for transport to the storage pond, chlorine contact chambers would not be necessary. Chlorine as gas or as sodium hypochlorite could be added directly to the wet well of the effluent pumping station. Therefore, no additional land would be needed for chlorine contact tanks. Space is available between Lagoons #5 and 6 for chlorine storage. Metering of the chlorine dose could be controlled by the operating speed of the effluent pump to assure effective, efficient use of the chlorine compound used.

Wastewater Treatment Processes for Stream Discharge -- Initial engineering studies in 1972 to bring Scottsbluff into compliance with secondary treatment requirements resulted in the recommendation to construct a new

secondary treatment facility. These alternatives, presented in the August 1975 Facilities Plan, considered:

- Complete mix activated sludge vs. activated bio-filter for wastewater treatment.
- Aerobic sludge digestion vs. no sludge digestion for solids treatment-either followed by vacuum filtration for solids concentration.
- Rehabilitation of I/I vs. no rehabilitation.

Costs for the least expensive alternative which does not consider I/I rehabilitation, activated bio-filter with sludge digestion, are used here to compare the treatment option of a new "mechanical" treatment plant with upgrading the existing treatment facilities to produce an effluent meeting stream discharge standards. While not explicitly proposed in the August, 1975 Facilities Plan, it is assumed here that part of the existing lagoon site will be converted for use under the "mechanical" treatment plant option.

Three options for upgrading the Scottsbluff lagoon system to meet secondary treatment requirements are discussed here. Each upgrading option is designed to accept design year BOD loads of 4,390 lbs/day, 7,020 lbs/day or 8,460 lbs/day depending on the level of pretreatment provided by Flanery Foods, Inc. The controlling design factor in these configurations is the 25 lb/acre/day BOD loading rate limit used by the State of Nebraska (Nebraska DEC, undated). Routing of flow through the lagoons approximates the lagoon configuration recommended in State of Missouri guidelines for stabilization lagoon design (Missouri DNR, personal communication). Because Nebraska guidelines for controlled discharge cannot be met with the existing lagoons, all lagoon upgrading options include an effluent clarification step prior to discharge to the North Platte River. Discussion of lagoon design criteria

and assumptions for the Scottsbluff system is included in Appendix J. The selection of DAF with chemical additions is discussed in Appendix K. Appendix Table J-3 lists the industrial pretreatment assumptions, municipal treatment units, and design factors for the three lagoon upgrading options.

Scottsbluff Wastewater Treatment Options -- In summary, six wastewater treatment options will be considered in system alternatives for Scottsbluff. Brief descriptions of these options and their relationships to industrial pretreatment and effluent disposal options are tabulated in Table III-6. Suggested flow routing and unit placement schemes for treatment prior to complete retention, land application and stream discharge are illustrated in Figures III-1, III-2, and III-3. Figure III-2 is a variation on Bell, Galyardt, and Wells' proposed configuration as shown in their Figure 7a in the Scottsbluff facilities plan. Treatment units and flow routing for mechanical treatment plants are illustrated in the Scottsbluff Facilities Plan.

b. Gering

Wastewater Treatment Options for Complete Retention -- The complete retention option presented in the February, 1977 draft Facilities Plan for Gering included modifications to the existing facility and addition of 360 acres of storage lagoon. The range of sizes for this new lagoon is strongly dependent on assumptions regarding percolation rates as shown in Table III-8, p. 150. Since there would be no stream discharge or crop irrigation, any additional treatment units considered would be for the purpose of preventing nuisances. In this regard two actions should be given consideration in this option: installation of screening and DAF units on the industrial sewers at some point to reduce the accumulation of scum on the anaerobic lagoons; and pumping raw domestic sewage directly to the new lagoons. Pretreatment of Swift & Co.'s and Stanko's wastewaters could be provided at the industries or as a preliminary treatment step at the municipal

Table III-6 - Wastewater Treatment Options - Scottsbluff

Municipal Wastewater Treatment Options	Industrial Pretreatment Option	Effluent Disposal Option
Upgrade Flow Distribution Facilities Only	No Pretreatment	Complete Retention
Add Aerated Cell, Upgrade Flow Distribution Facilities, and Collect Lagoon Overflow	No Pretreatment	Agricultural Irrigation
Construct Activated Bio-filter Facility	No Pretreatment	Stream Discharge
Upgrade Existing Lagoon System, Add Screening, DAF and Aerated Lagoon	No Pretreatment	Stream Discharge
Upgrade Existing Lagoon System, Add Aerated Lagoon	Screening and DAF (40% Removal of BOD; 65% removal of SS.)	Stream Discharge
Upgrade Existing Lagoon System Only	Maximum Pretreatment (90% removal of BOD and SS)	Stream Discharge

NOTE: Gravity flow distribution system redesigned to provide even flow to all cells. Distribution system utilizes open channel concrete lined trapezoidal ditch.

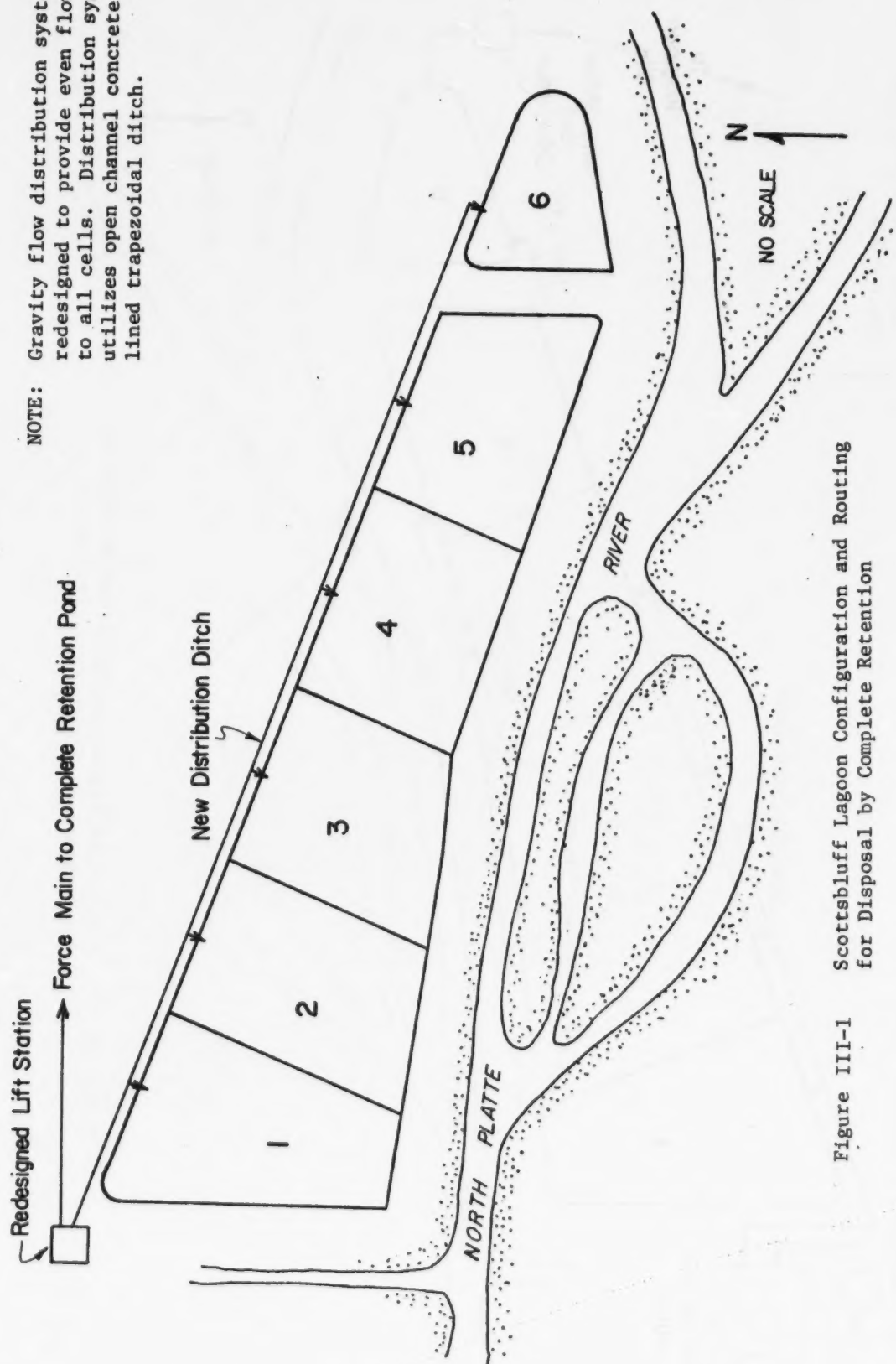


Figure III-1 Scottsbluff Lagoon Configuration and Routing for Disposal by Complete Retention

NOTE: New distribution system utilizes open channel concrete lined trapezoidal ditch to first four cells.

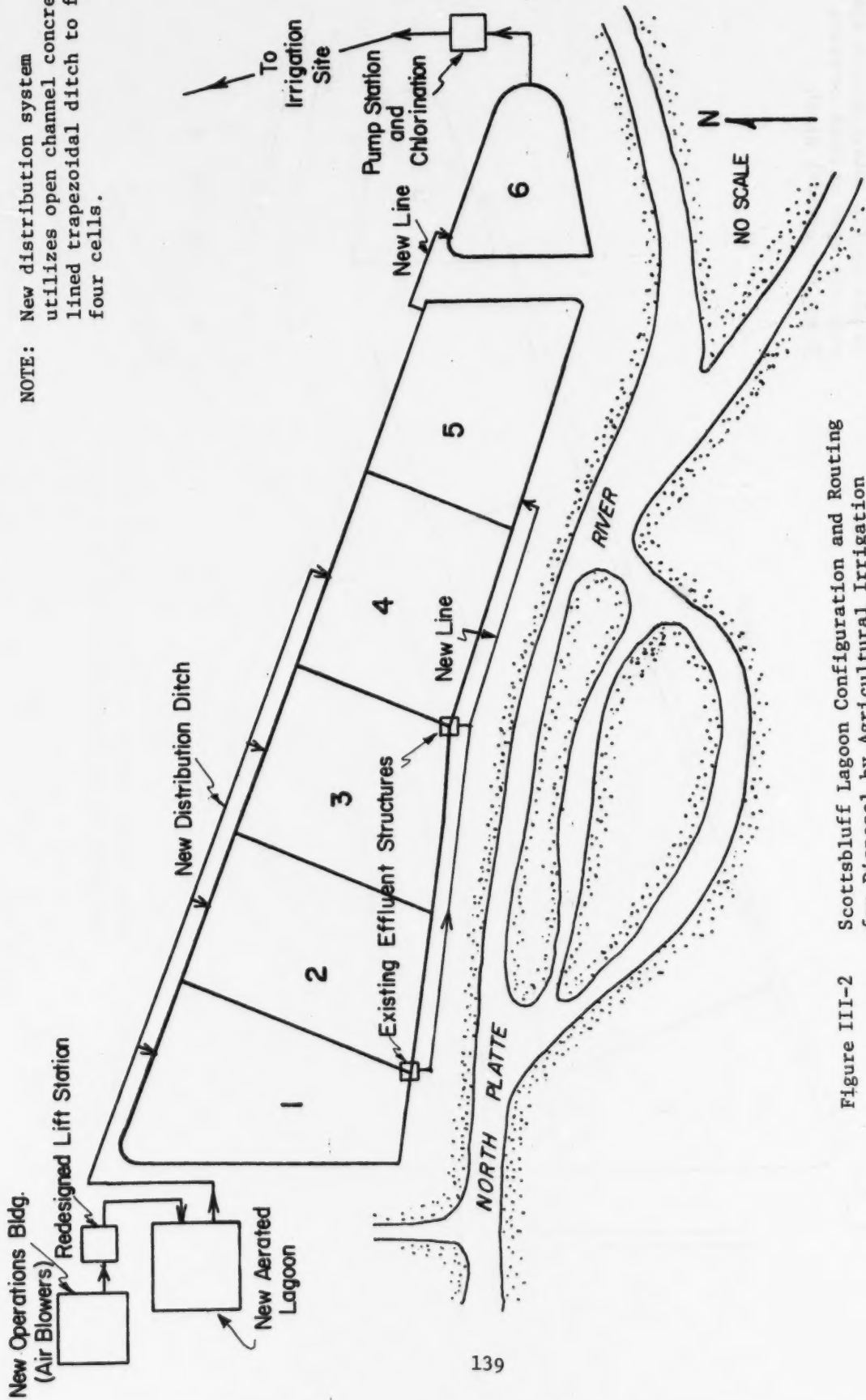


Figure III-2 Scottsbluff Lagoon Configuration and Routing for Disposal by Agricultural Irrigation

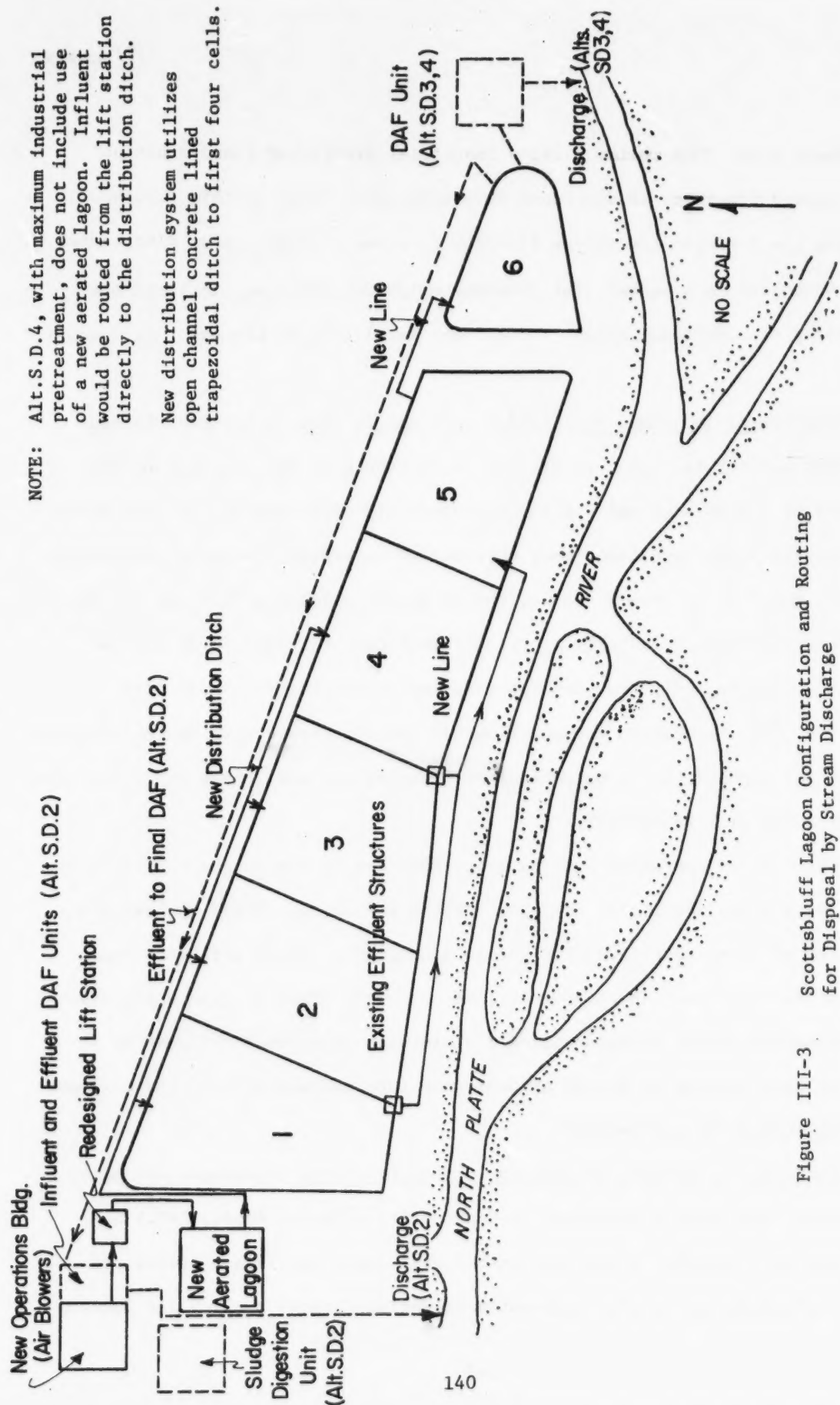


Figure III-3 Scottsbluff Lagoon Configuration and Routing for Disposal by Stream Discharge

treatment site. The choice between industrial pretreatment and municipal preliminary treatment is discussed more thoroughly later in this section. Routing the domestic raw sewage directly to a new storage lagoon distributes the wasteload in a manner that prevents nuisances and that precludes the necessity of additional domestic treatment facilities at the existing lagoon site.

Wastewater Treatment Options for Land Application -- Although lagoon effluent quality in regard to organic constituents is not critical to the success of system alternatives incorporating effluent disposal by land application, sufficient treatment must be provided to prevent nuisance conditions at the lagoon site. For instance, the 25 acres in lagoons #1.B and #2, while apparently working acceptably at current loadings of 87 and 76 lb BOD per acre-day, respectively, may develop nuisance conditions if loaded more heavily. Also, excessive accumulations of oil and grease scum on the anaerobic industrial lagoons should be avoided by reducing oil and grease concentrations in the industrial wastewater.

Four lagoon upgrading options are, therefore, being considered in relation to land application of Gering's treated effluents. These options are the same as those considered for stream discharge of these effluents except that no suspended solids removal will be necessary prior to land application. Due to public health considerations disinfection of treated effluent by injecting chlorine gas or sodium hypochlorite into the wet well of the effluent pumping station is recommended.

Wastewater Treatment Options for Stream Discharge -- Whereas the major industrial wastewaters generated in Scottsbluff (Flanery Foods, Inc.) are combined with the city's domestic wastes well above the lagoon system, the major industrial wastewaters generated in Gering (Stanko Packing and Swift &

Co.) remain separate from domestic wastewaters until the final stabilization lagoon #2. Treatment alternatives considered in the draft Facilities Plan for Gering dated February, 1977 all assumed continued separate treatment. Experience at Gering and elsewhere with anaerobic-aerated-stabilization lagoon treatment of meat processing wastewaters (EPA Technology Transfer, 1973) has shown that this system is capable of satisfactory treatment efficiencies. Options for municipal treatment of domestic wastewaters are considered separately from treatment of industrial wastewater. It is assumed that the existing industrial lagoon system will continue to be used in all alternatives.

All of the alternatives presented in the draft Facilities Plan for Gering included commitment of the entire existing lagoon system to industrial wastewater treatment. Reduction in industrial waste loads by screening and DAF (either at the municipal treatment plant site or at the industries) and initial treatment of domestic wastewater in a 5-acre aerated lagoon would allow the existing lagoon system to complete the stabilization process for both domestic and industrial wastewaters.

The draft Gering Facilities Plan also considered treating the domestic wastewater in a new 40-acre stabilization lagoon. With a design BOD load of 2,500 lb BOD/day, the state loading rate would be greatly exceeded in such a lagoon. The option that considers separate domestic wastewater treatment here includes 100 acres for this stabilization lagoon. The need for an additional storage lagoon to provide controlled discharge is eliminated by the inclusion of effluent clarification by dissolved air flotation with chemical additions. Design criteria and assumptions used in developing wastewater treatment options for Gering are discussed in Appendix K.

Wastewater Treatment Options for Gering -- All of the wastewater treatment options considered for Gering are tabulated in Table III-7. Unit siting and flow configurations are illustrated in Figures III-4 and III-5. It is assumed for all options that screening and DAF of Swift & Co.'s and Stanko Packing's wastewater will be provided at some point on the industrial sewer in order to preclude the otherwise insurmountable problems related to periodic burning of the scum layer.

c. Terrytown

Analysis of wastewater treatment options for Terrytown does not include linkage with industrial pretreatment or effluent disposal options. The treatment options are limited to upgrading the existing activated sludge treatment facility or eliminating the facility and transporting Terrytown's raw wastewater to either Gering or Scottsbluff. The means of upgrading the existing plant to provide reliable secondary treatment is discussed in Appendix M.

5. Effluent Disposal Options

Methods of disposing of treated effluent fall into three categories: reuse, land application, and discharge to surface waters. General considerations related to each of these categories are discussed here. Detailed design and operation considerations are included here for complete retention and agricultural irrigation, which are two techniques for land application. Irrigation would recycle potential sewage pollutants through the production of agricultural products. Additional considerations for agricultural irrigation are discussed in Appendices N and O.

a. Reuse

Three possibilities for reuse of treated wastewater recognized for the study area are cooling water for meat processing or petroleum refining plants, groundwater recharge, and commercial, non-sanitary water use.

Table III-7

Municipal Wastewater Treatment Options - Gering

<u>Municipal Wastewater Treatment Option</u>	<u>Effluent Disposal Option</u>
Route raw domestic wastewater directly to additional storage lagoon; Convert existing lagoon to industrial treatment	Complete Retention
Modify existing facilities; add 100-acre stabilization lagoon; chlorinate combined industrial and municipal effluents.	Agricultural Irrigation
Modify existing facilities; add 5-acre aerated lagoon; Chlorinate combined industrial and municipal effluents.	Agricultural Irrigation
Modify existing facilities; add 100-acre stabilization lagoon; suspended solids removal of combined industrial and municipal effluents	Stream Discharge
Modify existing facilities; add 5-acre aerated lagoon; suspended solids removal of combined industrial and municipal effluents.	Stream Discharge

Note: Each of the above options assumes that screening and DAF of the major industrial wastewaters will be provided to eliminate the problem of burning accumulated oil and grease scum. This process could be provided as a preliminary municipal treatment process.

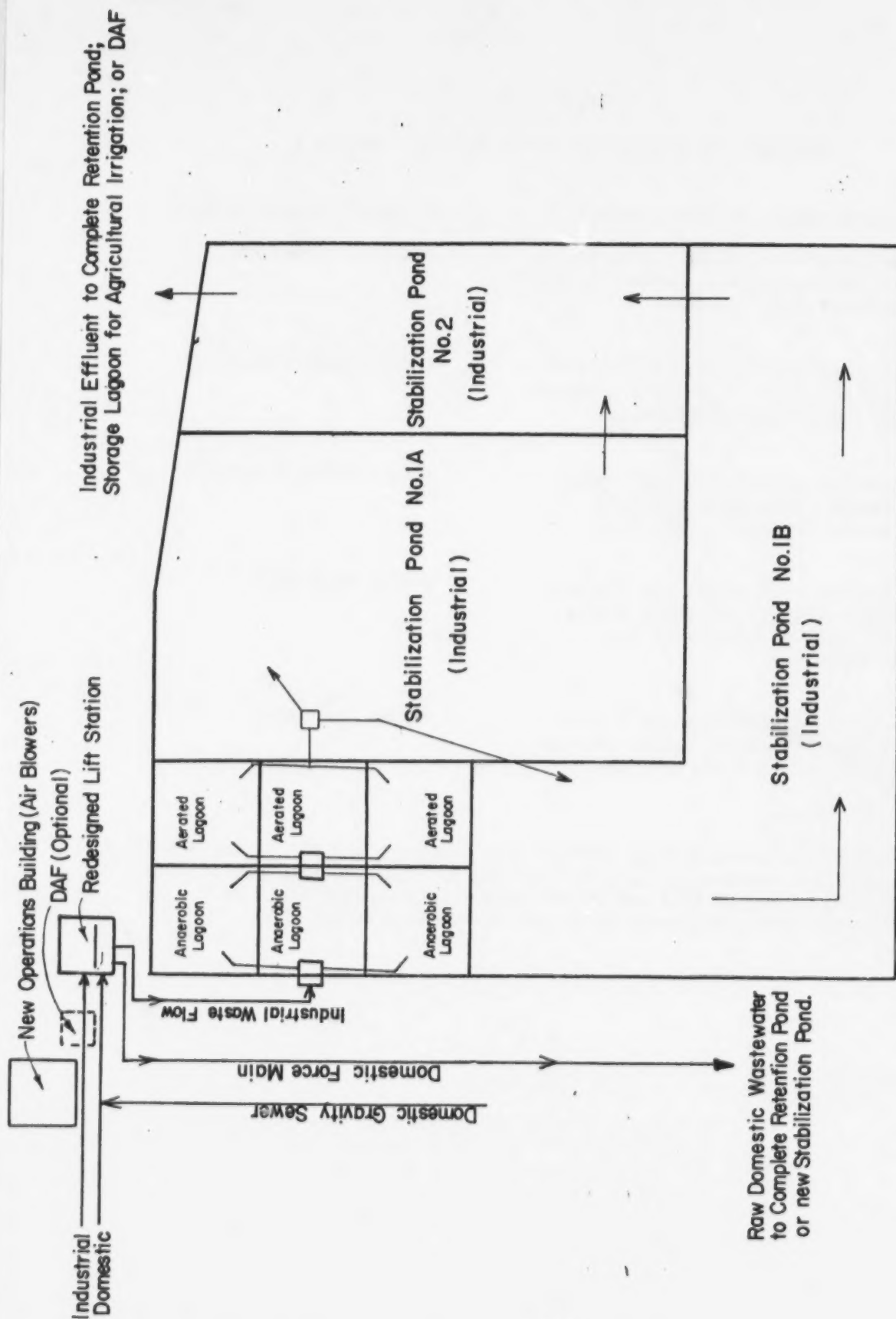


Figure III-4. Proposed Gering Lagoon Configuration and Routing - Existing Lagoons for Industrial Waste Only

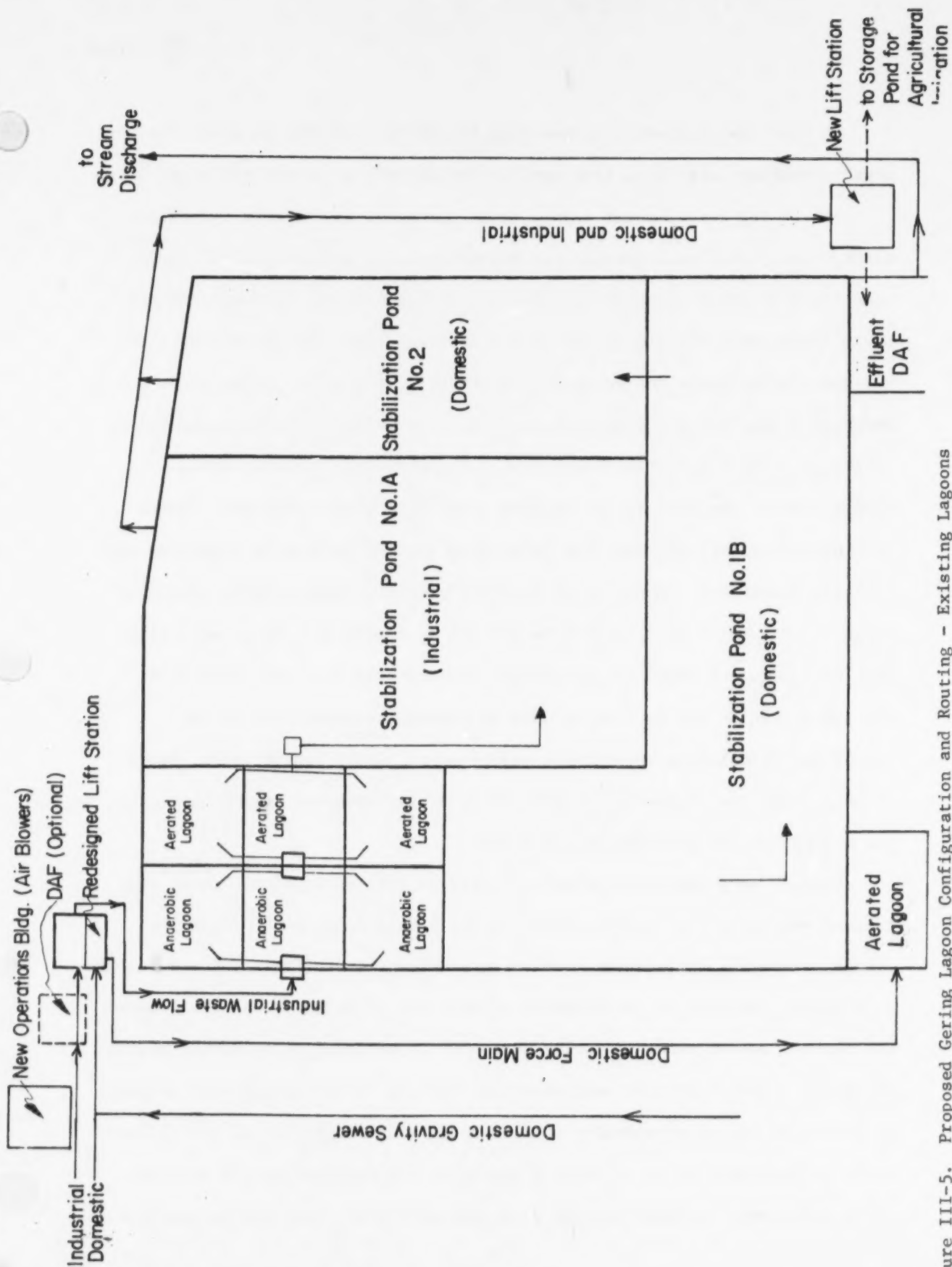


Figure III-5. Proposed Gering Lagoon Configuration and Routing - Existing Lagoons for Industrial and Domestic Wastes

In that use of treated wastewaters for irrigation will be given in-depth attention later as a land application method, it is not discussed here.

All of the area's water supply, with the exception of most irrigation water, comes from local groundwater resources. The availability of ample quantities of water from the sand and gravel deposits in the North Platte River Valley is a feature of the area's natural resources which doubtless has had a significant influence on the growth of the area. There is no indication that these groundwater resources are being depleted to the extent that supplemental recharge is necessary. Supplemental recharge using highly treated wastewaters is feasible given sufficient treatment. Based upon available effluent sampling data, nitrogen and pathogenic organisms are the only wastewater components which would necessitate wastewater treatment beyond that already envisioned here for stream discharge. Detailed evaluation of wastewater reuse by groundwater recharge has not been undertaken. The justification for performing such an evaluation would rest on the capability of existing groundwater resources to supply future needs. There is no present indication that projected water requirements cannot be met by the unsupplemented groundwater resources.

Demands on groundwater resources could be reduced by direct reuse of treated wastewaters as cooling water in the area's major meat processing plants or at CRA, Inc. Total cooling water requirements for these industries is unknown. Because of the hardness of both the groundwater and the treated wastewater, use of water softening equipment is necessary with either source of supply. Use of treated wastewater for cooling would be expensive compared to continued use of groundwater because additional filtration of the effluent would be necessary so as to avoid clogging of ion exchange resins used for water softening. Another problem with this method of reuse may be that the

industrial cooling equipment may not operate efficiently at the water temperature which would be reached in lagoon effluents during summer months. (This would not be as severe a limitation with activated sludge treatment.) Again, the need for protecting existing groundwater supplies would be the only justification for evaluating direct industrial reuse further.

With the exception of land application by agricultural irrigation, wastewater reuse options are not considered here in any more detail. Analysis of water resources and future water demands may call for considerations of these wastewater reuse possibilities at some time in the future.

b. Land Application

Two methods of land application have been considered in the Facilities Plans for Scottsbluff and Gering. These are complete retention and agricultural irrigation by center pivot. As discussed in Appendix N, agricultural irrigation by ridge and furrow application is feasible and cost-effective for two irrigation areas in the lower parts of the North Platte River Valley, identified in Figure I-3 as the North Valley and South Valley Irrigation Areas.

Complete Retention

The design of complete retention facilities involves only building additional storage ponds and transport equipment. Primary design considerations include percolation rate, acreage of wetted surface, depth of the ponds, and organic loading rate.

Percolation rate is the least predictable design factor for complete retention lagoons, but it critically affects their design, operation, and impacts on groundwater. The maximum allowable percolation rate according to Nebraska standards is 1/8" per day. Acreage for complete retention lagoons is calculated here using both 1/8" and zero percolation.

The wetted surface acreage for complete retention lagoons is dependent on projected flow and net annual lake evaporation as well as percolation. The net average annual water loss in the study area is 47.4 inches. The equivalent daily wastewater flow is 0.35 mgd per 100 wetted acres, assuming no percolation. Assuming a percolation loss of 1/8" per day, the equivalent daily wastewater flow doubles to 0.69 mgd per 100 wetted acres. The percolation rate of 1/8 in./day is for the design of complete retention lagoons. The allowable percolation rate is 1/4 in./day, as suggested by the Nebraska Department of Environmental Control. However, a 1/8 in./day percolation rate may be required for lagoon bottom construction due to soil condition and water table depth.

Table III-8 shows the total wetted, new wetted, and total new acreage required for complete retention lagoons at the municipal wastewater flows expected in the primary study area.

The maximum storage depth in complete retention lagoons should allow for 3 feet of freeboard and a minimum water level of two feet to minimize erosion problems and to prevent odor generation should the lagoons go dry. At the equivalent daily wastewater flow of 0.35 mgd per 100 acres (without percolation) the peak monthly storage depth for the design flow and worst rainfall conditions (25 year return) would be 14 inches or 1.2 feet. Total lagoon depth would be 6.5 feet.

The BOD loading rates for complete retention lagoons at design loads and design total wetted acreages are shown in Table III-8. The Nebraska organic loading rate limit of 25 lbs BOD/acre-day is exceeded only in Gering for the case where no industrial waste treatment is provided and the lagoons are sized to account for 1/8" per day percolation. Either screening and DAF or continued anaerobic/aeration treatment of meat packing wastes will reduce the load below the state standard for BOD.

Table III-8

Disposal by Complete Retention --
Organic (BOD) Loading

Alternative	BOD Waste Load lbs/day	With Percolation ^a		Without Percolation ^b	
		Wet Acres	BOD Loading lbs/acre/day	Wet Acres	BOD Loading lbs/acre/day
A All three towns	20762 (16302)	842	25 ^c (19) ^d	1653	13 (10)
B Scottsbluff & Terrytown	8834 (7386)	499	18 (15)	980	9 (8)
C Gering & Terrytown	12298 (9286)	378	33 (25)	743	17 (12)
D Scottsbluff	8464 (7016)	463	18 (15)	910	9 (8)
E Gering	11928 (8916)	342	35 (26)	672	18 (13)

^a Assumes moisture loss of 1/8" per day by percolation through bottom soil.

^b Assumes no percolation loss.

^c 25 No industrial pretreatment.

^d (19) Industrial pretreatment by Screening & DAF at meat packing plants.

The design of complete retention lagoons should include sealing the pond bottom and sides with Bentonite or comparable material to prevent excessive percolation into groundwaters. Multiple cells will reduce the reach for wave generation, thereby minimizing dike erosion.

The Facilities Plans for Gering and Scottsbluff considered two possible sites for new complete retention ponds: the North and South sites, which were also considered for agricultural irrigation. The reason for limiting consideration to these sites was that productive, already irrigated land in the valley would not be irretrievably committed to a non-productive use. This is an important and reasonable consideration, but it should not preclude examination of economies obtainable by constructing ponds in proximity to existing facilities. A valley site for complete retention could be located in the area illustrated in Figure I-3 and discussed in Section III.4.c. In examining these economies, it is also necessary to include the costs of lost agricultural productivity. This is done here for all new storage ponds considered in land application options.

Infiltration/Percolation

A land application technique which has not been previously considered is infiltration/percolation. Where soil permeability is high and groundwater standards can be met, allowing some or all of the treated wastewater to percolate to the groundwater is feasible. This technique would have the effect of replenishing groundwater supplies. Without nitrogen removal and effective disinfection, however, this technique is not appropriate in an area where wells are present on nearly every tract of land. Consideration of effluent disposal by infiltration/percolation would be contingent upon the same factors discussed in regard to wastewater reuse--the need to provide supplemental recharge of groundwater resources.

Overland Flow

A third method of land application, overland flow, has not previously been considered. To date, successful use of overland flow has been reported only for food processing wastes and has not been tried in full-scale operations with domestic wastewaters. The concept of applying water evenly to a gently sloping ground surface, allowing vegetation and surface soil to filter out solids and nutrients, could find use as a seasonal substitute for mechanical/chemical solids removal prior to stream discharge. It is doubtful whether crops could be harvested from the acreage used so that land used would be retrievably committed to the one purpose of polishing treated effluent.

Agricultural Irrigation

Agricultural management practices related to using treated sewage effluent for crop irrigation are discussed in Appendix N. A number of design variables must be considered in order for agricultural irrigation options to be defined. These variables are: crop selection, irrigation water quality (especially total dissolved solids, boron, and total nitrogen), method of application, leaching rates for control of total dissolved solids in the soil water, and control of percolating water below the crop root zone.

The tolerance of various crops to water quality parameters, especially total dissolved solids (TDS) and boron, their nitrogen uptake rates, and water requirements, are listed in Table N-1 in Appendix N. Based on these parameters and economic considerations, including marketability and financial return, sugar beets have been chosen as the design crop. Sugar beets offer the advantages of maximum tolerance to both TDS and boron. In addition, there is an existing major market for sugar beets in the area. As a means of assuring an amount of flexibility in the design of an agricultural irrigation system, a second design crop, corn, is also considered. Reed canary

grass, considered in the Facilities Plans, is not used here because interpretation of available data (USDA, 1954; EPA, 1975) indicates that it is unacceptably sensitive to total dissolved solids.

The conclusion that TDS, nitrogen, and boron are the parameters of most importance in using the wastewaters investigated here for irrigation is based on a review of wastewater data for the three towns, the engineering analyses in the Facilities Plans, and literature on the level of water quality necessary for irrigation. Water quality parameters addressed in the Facilities Plan which were found not to present a problem in use of the wastewaters under study for irrigation were sodium adsorption ratio (SAR), total suspended solids (TSS), and volatile suspended solids (VSS).

To determine the final concentration of TDS, nitrogen, and boron in the wastewaters used for irrigation, the untreated flows and waste loads in each of the towns were estimated. (See Appendix Table O-1.) The amount of reduction in nitrogen through pretreatment of industrial wastes by screening and DAF was also estimated.

A monthly water balance and a concentration budget for one parameter, TDS, were then completed for Scottsbluff alone using design flows, estimated waste loads, and estimated removals or losses affecting concentrations via lagoon treatment and storage in the irrigation holding pond. A discussion of the methodology used appears in Appendix O. The monthly concentration budget yielded the final concentrations of TDS in the effluent from the irrigation holding pond, and also individual monthly concentration factors which are the ratio of the end of month mixed concentrations in the storage pond to the original concentration in the raw wastewater flow. These monthly concentration factors for TDS were then also used to project the concentration of the two other parameters, nitrogen and boron, in the applied irrigation water for Scottsbluff.

Assuming that the degree of concentration of conservative elements in the wastewaters from the point of origin of the waste flow to the final irrigation application will be nearly the same for Gering and Terrytown as for Scottsbluff, the monthly concentration factors were applied to the various regional alternative waste sources to estimate the applied irrigation water quality in each case. For each alternative a single concentration factor representing the average concentration over the five month period of irrigation was used. The initial concentrations of the three water quality parameters in the waste sources and in the final storage pond effluent (applied irrigation water) for the regional alternatives appear in Appendix Table O-3.

Hydraulic loading rates estimated here include a leaching requirement which is the fraction of applied irrigation water that must be leached through the root zone to control soil salinity. Estimates of leaching requirements are calculated assuming uniform distribution of irrigation water and adequate internal soil drainage.

The hydraulic loading rates for the design crops, sugar beets and corn, are 26 inches and 24 inches per growing season, respectively. An irrigation water flow of 27.8 inches per acre per season has been used in sizing irrigation plots (wetted areas). This design hydraulic loading rate is based on a probable long term rate of 25 inches per season adjusted upward by 10% to account for water losses by drift and evaporation prior to reaching the ground. The amount of cropland and the size of the storage pond needed for each of the regional irrigation alternative appear in Appendix Table O-2.

At an hydraulic loading rate of 25" over the growing season the amount of nitrogen applied to the wetted crop area, assuming concentrations of

nitrogen in the irrigation water shown in Appendix Table O-3, varies from 125 lbs N/acre/yr if wastewater from Scottsbluff alone is used, to 204 lbs N/acre/yr if Gering waste alone is applied. These nitrogen loading rates assume no pretreatment of industrial wastes. Compared to the nitrogen loading limit of the State of Nebraska for sugar beets of 200 lbs N/acre/yr, all alternatives except the use of wastewater from Gering alone have acceptable nitrogen loading rates. Since all calculated nitrogen loading rates are close to or below the acceptable limit for sugar beets, the irrigation acreage requirement was not adjusted on the basis of the nitrogen uptake rate.

Since the major source of nitrogen in the wastewater flows is industrial waste, the nitrogen loadings were also calculated on the basis of assuming industrial pretreatment which results in the irrigation water nitrogen concentrations also shown in Appendix Table O-2. The corresponding loading rates for the alternatives with industrial pretreatment range from 113 to 160 lbs N/acre/yr., which are within the acceptable limit.

Boron concentrations are estimated to increase to the range of 1.2 to 1.7 mg/l. Sugar beets are rated tolerant and corn is rated semi-tolerant to boron. As discussed in Appendix O, the calculated average boron concentrations in the applied irrigation water would not be expected to preclude irrigation of sugar beets or corn. However, as wide variations in boron concentrations were found in previous wastewater sampling, and as these concentrations are only marginally acceptable, additional boron analysis should be undertaken prior to implementation of agricultural irrigation. Specifically, an extensive boron monitoring program would be arranged, and, if high concentrations are found, an attempt to locate and control the sources should be made.

The actual method of irrigating the cropland must provide for water distribution and leaching in such a way as to prevent salt accumulation in the root zone, which would be detrimental to the crop. It is recommended, therefore, that design of ridge and furrow irrigation at the North Valley and South Valley Irrigation Areas include wide-bottom furrows, and include plowing and mixing of the soil and rotation of crops to decrease salt accumulation. Provisions need also to be included for temporary conversion to irrigation by flooding for the same reason. Ridge and furrow irrigation is the method of choice for relatively level topography.

Spray irrigation by center pivot is recommended in those areas where the topography is not level. An advantage of the spray irrigation method is that it allows more precise control of water depth and distribution. The center pivot method has a drawback in that the corners of the irrigation plots are not easily covered.

The assumption of adequate drainage necessitates location of the agricultural irrigation system on well-drained soils. Adequate soils are present on the four sites considered for agricultural irrigation.

Stream Discharge

Discharge of treated effluents to the North Platte River is the effluent disposal method now practiced at all three municipal wastewater treatment plants in the Primary Study Area.

Upgrading of the Terrytown plant would require no alteration of the present effluent outfall line.

Upgrading of the Scottsbluff lagoon system for stream discharge would eliminate the three existing outfalls. These would be replaced by a single discharge structure at either the west or east end of the lagoon system, as illustrated in Figure III-3. A new activated biofilter plant at the site

would also have a new, single effluent outfall.

Upgrading of the Gering lagoon system for stream discharge would involve rerouting of lagoon discharges to a new DAF unit located at the southeast corner of the lagoons. New sewers would be installed in the lagoon dikes for that purpose. Discharge from the DAF unit would be through a new outfall line discharging to the North Platte at the present discharge point north of the northeast corner of the lagoon system.

Regionalized stream discharge alternatives would use outfalls discharging to the North Platte River.

6. Sludge Handling and Disposal

Sludge handling and disposal problems in the study area at present appear to be minimal. Grease trap scum and sludges from the meat packing plants are rendered. Bar-screened wastes from the industrial sewer in Gering and the main interceptor in Scottsbluff are landfilled at these municipalities' landfills. The problems with wastewater solids at present are that they settle out in the stabilization lagoons and periodically are resuspended and discharged in the lagoon effluent. Any alternative to improve wastewater treatment efficiencies to meet standards for stream discharge is, therefore, going to result in greater sludge volumes for processing and disposal. Alternatives including effluent disposal by complete retention or agricultural irrigation would not generate sludges requiring handling and disposal.

Wastewater solids can be removed at nearly any point in the wastewater treatment process. Solids removal necessitates solids disposal, which in turn requires measures to make the sludge streams suitable for disposal. Consideration of the complex technical, environmental, and economic tradeoffs of selecting complete sludge management options was avoided in the Scottsbluff, Gering, and Terrytown Facilities Plans. Only a cursory evaluation of sludge

handling and disposal options is presented here. This evaluation is only comprehensive and detailed enough to support consideration of cost and environmental effects of sludge management in the overall cost-effectiveness of systems and regional alternatives. Detailed design of the proposed action should include further evaluation of sludge quantity and quality, groundwater impacts of sludge landfilling, and overall environmental impacts of land application.

a. Types and Quantities of Sludges Generated by the Industrial Pretreatment and Wastewater Treatment Process Options

The types, quantities and characteristics of the sludges generated by the various waste treatment systems are described below.

Gering -- The sludge that could be generated at the Gering plant, assuming no pretreatment by Stanko Corp. and Swift & Co. include:

- Screening and DAF residues from municipal pretreatment of the meat packing wastewaters from Stanko Corporation and Swift and Company.
- DAF sludge from effluent clarification.

Screening and dissolved air flotation of combined meat packing wastes at the municipal plant site will generate residues consisting of meat, fat, hair, bone particles, and oil and grease. The quality of this residue may not be high enough to be reclaimed by rendering because of hair and other undesirable materials. Past attempts in Gering to recover meat packing waste solids for resale to the meat packers have met with failure because of the residue's low quality. The residue, therefore, created a solid waste disposal problem for the City. Because of this potential disposal problem, oil and grease removal by the industries only from those waste streams containing significant quantities is recommended over municipal removal. Application of DAF without chemical addition to selected waste streams by the

industries should result in a higher quality residue that will meet the City's need to minimize scum accumulation on their anaerobic lagoons, avoid a solid waste disposal problem, and allow recovery of oil and grease for tallow. If DAF units are installed at the municipal site, approximately 10,000 pounds per day net weight, 6,000 lbs/day dry weight, of solids will be generated.

All stream discharge alternatives for Gering include effluent clarification by DAF with chemical additions. The residue from effluent clarification will consist of chemical precipitates, blue-green and green algae, and dead bacteria and other microorganisms. The quantity of this residue is expected to vary from a range of 2,000 to 3,000 pounds per day dry weight when algae are actively growing in the lagoons to a range of 1,000 to 2,000 pounds per day dry weight during cold weather.

Scottsbluff -- The three sludge streams that could be generated at the Scottsbluff facility include:

- Screening and DAF sludge generated by preliminary treatment of combined raw municipal and industrial wastewater. This sludge stream would be generated only if Flanery Foods provides no removal of oil and grease on its own.
- DAF sludge from effluent clarification.
- Mixed primary and excess activated sludge from an activated bio-filter plant.

Flanery Foods, Inc., wastewater is not segregated from the domestic waste as is the case at Gering, which poses a different sludge problem when

no pretreatment is practiced by the meat packing plant. The O&G content of the total waste stream is approximately 2,000 pounds per day at design load and the suspended solids will be 9,000 pounds per day.

The O&G constituent is primarily fat discharged by the packing plant. If municipal removal of oil and grease is necessary, removal of 2,000 pounds of oil and grease per day is anticipated utilizing a DAF system which will also remove 6,000 pounds per day of suspended solids. The resulting residue will consist of domestic sewage solids mixed with meat, fat and bone particles from the packing plant. At design load it is expected the 8,000 pounds per day dry weight of sludge will be generated. This sludge, due to the presence of domestic sewage, cannot be sent to a rendering plant as might be possible at Gering. The solids removed by DAF will be treated by anaerobic digestion, then combined with the sludge generated by the DAF of the effluent, and vacuum filtered prior to ultimate disposal.

The effluent from the stabilization pond, as at Gering and for identical reasons, will be treated using a dissolved air flotation system. The quantity of sludge generated will vary from 3,000 to 4,000 pounds per day during the summer season and 2,000 to 3,000 pounds per day in the winter season. The sludge characteristics will be the same as those described for the Gering plant.

The activated bio-filter plant presented as an alternative in the Scottsbluff Facilities Plan would generate 10,260 lbs/day dry weight of mixed primary and biological sludges.

Terrytown -- If Terrytown's activated sludge treatment plant is continued in use, approximately 2,000 lbs/month of excess activated sludge will have to be disposed of. Prior to disposal it should be digested and dewatered. If sludge digestion facilities are available elsewhere in the study area, the most attractive means of providing digestion, dewatering and disposal would be jointly with that facility. For instance, Scottsbluff alternatives S.D. 1 and S.D. 2 would require anaerobic digestion and dewatering facilities. If other facilities are not available locally, digestion on-site followed by sand drying beds would be the least-cost method of preparing the small quantity of sludge for landfilling.

b. Stabilization

Of the various sludge streams expected from the system alternatives, three would have to be stabilized (decomposition of volatile organic compounds) prior to final disposal. These sludge streams are the mixed primary and excess activated sludge from an activated biofilter plant in Scottsbluff, excess activated sludge from Terrytown's plant and the raw sludge from dissolved air flotation of combined municipal and industrial wastewaters in the Scottsbluff "No Pretreatment" alternative. Stabilization is normally practiced to reduce odor problems at the disposal site and to reduce the volume of sludge to be disposed. An additional benefit of stabilization is a reduction in pathogenic organisms although significant numbers of pathogens can remain in well digested sludge.

Stabilization of sewage sludges is typically accomplished by either anaerobic or aerobic processes. Anaerobic digestion facilities are relatively more expensive in construction costs than aerobic digestion facilities, especially for very small (<1.0 mgd) treatment plants. However, because of electricity costs for aerating sludge, overall cost comparisons

increasingly favor anaerobic digestion as sludge volumes increase. While aerobic digestion is a feasible method for stabilizing excess activated sludges, it would not be appropriate for the raw DAF sludge generated in the "No Pretreatment" alternative for Scottsbluff.

Based upon feasibility and overall cost comparisons, the appropriate stabilization processes for the three sludge streams of concern are:

- Excess activated sludge from an activated bio-filter plant in Scottsbluff stabilized by two-stage anaerobic digestion
- Excess activated sludge from the upgrading alternative for Terrytown stabilized by aerobic digestion.
- Raw DAF sludge from the Scottsbluff "No Pretreatment Alternative" stabilized by two-stage anaerobic digestion.

Other sludge streams generated by the system alternatives could cause odor problems if not properly managed. However, less expensive stabilization measures than anaerobic or aerobic digestion could be used such as lime treatment.

c. Sludge Dewatering

Sludges generated by DAF units treating the raw industrial wastewater in Gering will be collected and removed by tank truck to a local rendering plant and so require no dewatering.

Sludges generated by the DAF units removing solids from the final combined domestic and industrial effluents in Scottsbluff and Gering will be dewatered utilizing vacuum filtration prior to ultimate disposal.

In Scottsbluff alternative S.D. 2 (see Section III.C.), the sludges developed at the Scottsbluff treatment plant will be combined in a sludge storage tank and vacuum filtered prior to removal to landfill. The combination of anaerobically digested sludge removed from the raw waste stream,

and the sludge removed by DAF from the final effluent, should be suitable for vacuum filtration.

Anaerobically digested sludge from the Terrytown plant will be dewatered using sludge drying beds. 700 square feet of drying bed can be located within the dike that protects the plant site. Drying beds would be lined to prevent filtrate from entering the groundwater, and filtrate would be returned to the head of the treatment plant. If sludge digestion and dewatering facilities are available at Scottsbluff, neither aerobic digestion facilities nor drying beds will be necessary in Terrytown.

d. Disposal

Three methods of sludge disposal are feasible for the various sludge streams listed above. These methods are landfill, land application, and rendering. Wastewater treatment residues presently generated in the study area include only coarse solids from municipal raw sewage screening and the grease and solids from meat packing plant grease traps. These wastes are presently deposited in the cities' sanitary landfills (screenings) or are rendered on-site (meat packing).

Rendering of meat packing waste solids collected by fine screens is the obvious disposal method of choice for this sludge stream. Depending on the need to add chemicals prior to dissolved air flotation of the meat packing wastes and the feasibility of including such chemicals in rendered wastes, the residues from industrial dissolved air flotation units may also be renderable. Recovery of the screening and DAF sludges by rendering would partially offset capital and operating costs of the pretreatment facilities.

Some of the sludge streams that would be generated by various system or regional alternatives may be amenable to disposal by land application.

that is, spreading the sludge on the land surface and incorporating it into the soil. Specifically, effluent clarification residues and digested activated sludge could be disposed of by land application. Nutrient recovery and use of the organic content of sludges could be advantages to land application of sludges in windrows, soils subject to wind erosion, and non-food-crop acreage. Well-managed land application of sludges also has the potential for avoiding adverse groundwater impacts that could occur from direct landfilling of wastewater sludges. Consideration of land application for sludge disposal should be given to the alternatives selected for implementation if the selected alternative (proposed action) generated substantial quantities of sludge amenable to this disposal method. Sludge stabilization, pathogen reduction, groundwater protection, control of surface water runoff, heavy metals, and pesticide content of the sludge, site monitoring, and application rates would have to be considered in any proposal to dispose of sludge by land application.

The heavy metals and pesticide content of potential sludge streams is expected to be low enough to permit their disposal by land application. Zinc in Lockwood Corporation's wastewater is the only identified potential source of heavy metals in the Primary Study Area. If wastewater sludges concentrate this zinc to levels unacceptable for land application, pretreatment of Lockwood's process wastewater could be required to limit zinc in Gering's sludge. Land application of adequately stabilized sludges is a feasible alternative to landfilling of sludges. Implementation of this sludge disposal method would require identification of suitable application sites and development of agreements between landowners and the municipalities to use the sites.

Landfilling of sludges is commonly practiced and is an acceptable

disposal method where odor, groundwater contamination, and potential public health problems can be avoided. Odor problems could result from landfilling of two sludge streams: excess activated sludge and dissolved air flotation sludge from preliminary treatment of combined industrial and municipal wastewaters in Scottsbluff. Stabilization of these sludges by aerobic digestion (activated sludge) or anaerobic digestion (DAF from combined wastewaters) is, therefore, included as part of the sludge handling and disposal options for these sludges. Groundwater contamination, especially by nitrates, is a possible consequence of landfilling sludges. Removal of nitrogenous substances from sludges would be complex and costly. In addition, provision should be made to prevent public access to landfill areas used for disposal of any untreated sludges.

e. Summary of Sludge Streams, Handling, and Disposal

Table III-9 lists the sources and estimated daily (monthly for Terrytown) volumes of sludge streams generated by the various industrial pretreatment options and municipal wastewater treatment options considered in systems alternatives development. Stabilization, dewatering and disposal methods selected for each sludge stream, based upon considerations explained in the preceding text, are also presented.

C. **SYSTEM ALTERNATIVES**

1. Introduction

Methods for providing the functional components of wastewater management systems in each of the three study area municipalities were discussed by component in the preceding section. It remains to list the reasonable combinations of component options which will represent alternative wastewater management systems for each municipality. The alternative lists for

Table III-9

**Summary of Sludge Streams Generated by Industrial Pretreatment and
Municipal Wastewater Treatment Options: Quantities and Handling
and Selected Disposal Techniques**

Source	Quantity dry solids lbs/day	Sludge Handling and Disposal Techniques		
		Stabilization Process	Dewatering Process	Ultimate Disposal Method
<u>Flannery Foods</u>				
DAF by Industry	6000	None Required	None	Rendering
<u>Scottsbluff</u>				
Raw Waste DAF	8000	Anaerobic Digestion	Vacuum Filtration	Landfill or Land Application
Effluent Clari- fication DAF	3500 summer 2500 winter	None Required	Vacuum Filtration	Landfill or Land Application
Lagoon Deposits	Not readily quantifiable	Self-stabilized	Evaporation in Drained Lagoon	Landfill or Land Application
<u>Stanko Corp.</u>				
DAF by Industry	2000	None Required	None	Rendering
<u>Swift & Co.</u>				
DAF by Industry	6000	None Required	None	Rendering
<u>Gering</u>				
DAF by Municipality of meat- packing wastewaters				
Effluent Clari- fication	2500 summer 1500 winter	None Required	Vacuum Filtration	Landfill or Land Application
Lagoon deposits	Not readily quantifiable	Self-stabilized	Centrifuge or Vacuum Filter	Landfill or Land Application
<u>Terrytown</u>				
	<u>lbs/mo.</u>			
On-Site Handling	2000	Aerobic Digestion	Sludge Drying Beds	Landfill or Land Application
Off-Site Handling	2000	Truck to Scottsbluff for anaerobic digestion, vacuum filtration and landfill (only in con- junction with appropriate Scottsbluff alterna- tives.)		

each municipality are presented below in Section III.C.2 along with estimated present worth and cents/1,000 gallons treated costs for each alternative. Numerous subalternatives based on unresolved design considerations such as alternate effluent clarification processes, infiltration rehabilitation, sewer or force main routings, sludge disposal, and alternative methods of achieving certain industrial pretreatment efficiencies have not been included in these lists since they are expected to have less than decisive impacts on the economic or environmental attractiveness of the system alternatives. Decisive factors in the selection of alternatives, such as levels of industrial pretreatment, wastewater treatment processes, and effluent disposal methods, are represented in these alternatives. The costing methodology and assumptions used to estimate present worth and unit flow costs are described in Appendix P. Details of the cost-effective analysis for each alternative are presented in Appendix Q.

2. Alternatives

Because the choice of components options for industrial pretreatment, wastewater treatment processes, and sludge disposal are closely linked with the types of effluent disposal considered, system alternatives for Scottsbluff, Gering and Terrytown are grouped in Tables III-10, III-11, and III-12 according to effluent disposal options. For clarity, the component options are identified briefly in these Tables. Design, management and siting considerations were discussed in Section III.B.

D. REGIONALIZATION OPTIONS

Because of the proximity of the three existing municipal wastewater treatment facilities and because of functional similarities between the two larger facilities, the most cost-effective wastewater management alternative

Table III-10

Component Options - Scottsbluff

Alternative Identification	Industrial Pretreatment	Collection System	Treatment Plant Siting	Wastewater Tmt. Process	Effluent Disposal	Sludge Management	Present Worth (\$1000)	Overall Municipal Treatment Cost (\$/1000 gal.)
CRM (Complete Retention, N. Site)	None	No Rerouting	Existing Lagoon	Upgrade Influent Distribution	Complete Retention North Site	No Sludge	6566	52.73
CRS (Complete Retention, S. Site)	"	"	"	"	Complete Retention South Site	"	5397	43.35
CRV (Complete Retention, Valley Site)	"	"	"	"	Complete Retention Valley Site	"	3579	28.74
AIN (Agricul- tural Irriga- tion, N. Site)	"	"	Existing Lagoons + 10 acres for Aerated Lagoon	Add aerated lagoon, up- grade influ- ent distri., collect lagoon overflow, chlorinate	Agricultural Irrigation North Site	No Sludge	7135	57.30
AIS (Agricul- tural Irriga- tion, S. Site)	"	"	"	"	Agricultural Irrigation South Site	"	6065	48.71
AIV (Agricul- tural Irriga- tion, Valley Site)	"	"	"	"	Agricultural Irrigation Valley Site	"	7310	58.71
SD 1 (Stream Discharge #1)	"	Reroute Airport Sewer to Headworks	Fill Existing Lagoons	Activated bio-filter with nitrification	Stream Discharge	Anaerobic digestion, Vacuum fil- ter and Landfill or Land Application	7288	58.54

Table III-10

Component Options - Scottsbluff - Cont'd.

Identification	Industrial Pretreatment	Collection System	Treatment Plant Siting	Wastewater Tmt. Process	Effluent Disposal	Sludge Management	Present Worth (\$1000)	Overall Municipal Treatment Cost (c/1000 gal.)
SD 2 (Stream Discharge #2)	None	Reroute Airport Sewer to Headworks	Existing Lagoons + 12 acres for Aerated Lagoon, DAF units	Screen and DAF preliminary treatment, add aerated lagoon, upgrade flow distribution to 4-1-1 configuration, effluent DAF	Stream Discharge	Anaerobic digestion & vacuum filter DAF solids from preliminary treatment and from effluent clarification.	6356	51.05
SD 3 (Stream Discharge #3)	Screening plus DAF	"	"	Add aerated lagoon, upgrade flow distribution to 4-1-1 configuration, effluent DAF	"	Landfill or Land Application Vacuum filter 4068 DAF solids from effluent clarification	4068	32.67
SD 4 (Stream Discharge #4)	Maximum Pretreatment	"	Existing Lagoons	Upgrade flow distribution to 4-1-1 configuration, effluent DAF	"	Landfill or Land Application	2394	19.23

Table III-11

Component Options - Gering

Alternative Identification	Industrial Pretreatment	Collection System	Treatment Plant Siting	Wastewater Tmt. Process	Effluent Disposal	Sludge Management	Present Worth (\$1000)	Overall Municipal Treatment Cost (\$/1000 gal.)
CRN (Complete Retention, N. Site)	Screening & DAF by industry	No Change	Existing Lagoon for Industrial Wastes	Continue Industrial Treatment in existing plant, North Site Raw domestic waste and any industrial effluent to complete retention lagoon	Complete Retention	No sludge	6685	76.64
CRS (Complete Retention, S. Site)	"	"	"	"	Complete Retention South Site	"	5318	57.79
CRV (Complete Retention, Valley Site)	"	"	"	"	Complete Retention Valley Site	"	3524	38.28
AIN 1 (Agricultural Irrigation, N. Site #1)	"	"	Existing lagoons for Industrial wastes plus new 120 acre site for domestic stabilization lagoon	Continue Industrial Treatment in existing plant. New stabilization lagoon for domestic wastes	Agricultural Irrigation North Site		7034	76.44
AIS 1 (Agricultural Irrigation, S. Site #1)	"	"	"	"	Agricultural Irrigation South Site	"	5651	61.40
AIV (Agricultural Irrigation, Valley Site #1)	"	"	"	"	Agricultural Irrigation Valley Site	"	6287	68.32

Table III-11

Component Options - Gering - Cont'd.

Alternative Identification	Industrial Pretreatment	Collection System	Treatment Plant Siting	Wastewater Tmt. Process	Effluent Disposal	Sludge Management	Present Worth (\$1000)	Overall Municipal Treatment Cost (¢/1000 gal.)
SD 1 (Stream Discharge #1)	Screening & DAF by industry	No Change	Existing lagoons for industrial wastes plus new 120 acre site for domestic stabilization lagoon	Existing Facili- ties for indus- trial wastes. New stabilization lagoon for domestic waste. DAF for com- bined effluents	Stream Discharge	Vacuum filter DAF sludge Landfill or Land Application	4026	43.74
SD 2 (Stream Discharge #2)	"	"	Existing lagoons for industrial and domestic wastes plus 5 acres for aerated lagoon	Existing anaerobic and aerated cells plus lagoon #1A for industrial wastes. New aerat- ed lagoon and La- goons #1B & #2 for domestic wastes. DAF for combined effluents	"	Vacuum fil- ter DAF sludge. Landfill or Land Application	3729	40.52
AIN 2 (Agricul- tural Irrigation, North Site #2)	"	"	Existing la- goons for Industrial and domestic waste plus 5 acres for aerated lagoon	Existing anaerobic and aerated cells plus lagoon #1A for Industrial wastes. New aerated lagoon and lagoons #1B and #2 for domestic wastes. DAF for combined effluents	Agricultural Irrigation Sludge No for North Site	No	6981	75.86

Table III-11

Component Options - Gering - Cont'd.

<u>Alternative Identification</u>	<u>Industrial Pretreatment</u>	<u>Collection System</u>	<u>Treatment Plant Siting</u>	<u>Wastewater Tmt. Process</u>	<u>Effluent Disposal</u>	<u>Sludge Management</u>	<u>Present Worth (\$1000)</u>	<u>Overall Municipal Treatment Cost (¢/1000 gal.)</u>
AIS 2 (Agricul- tural Irriga- tion, S. Site #2)	Screening & DAF by industry		Existing la- goons for industrial and domestic waste plus 5 acres for aerated lagoon	Existing anaerobic and aerated cells plus lagoon #1A for South Site industrial wastes. New aerated lagoon and lagoons #1B and #2 for domestic wastes. DAF for combined effluents.	Irrigation	No Sludge	5792	62.93
AIV 2 (Agricul- tural Irriga- tion, Valley Site #2)	"		"	"	Agricultural Irrigation Valley Site	"	6333	68.81

Table III-12

Component Options - Terrytown

Alternative Identification	Industrial Pretreatment	Collection System	Treatment Plant Siting	Wastewater Tmt. Process	Effluent Disposal	Sludge Management	Present Worth (\$1000)	Overall Municipal Treatment Cost (¢/1000 gal.)
Terrytown #1	N.A.	N.A.	Eliminate treatment of existing site. Transport raw sewage to Gering or Scottsbluff. (See Sec. III.D.)	Raw sewage pump- ing station only	N.A.	N.A.	a	a
Terrytown #2	N.A.	N.A.	Existing Site Upgrade existing plant		Stream Discharge	Tank truck excess waste activated sludge to Scottsbluff for digestion, dewatering and landfill, if these facilities are available there. (Scottsbluff Alter- natives SD.1 and S.D.2)	275	28.50
Terrytown #3	N.A.	N.A.	Existing Site Upgrade existing plant		Stream Discharge	Aerobic Di- gestion, sludge dry- ing beds. Landfill or Land Application	3824	39.64

^a Present worth and unit treatment costs would depend almost entirely on charges for sewerage services provided by Gering or Scottsbluff.

for the study area could involve combinations of one or more functional components to provide areawide service. Of the six functional components used in this study, four could be regionalized. These are:

- Treatment Plant Siting - regionalization of this component would involve either treating all wastewaters at one site and abandoning all existing treatment facilities or else simply phasing out Terrytown's treatment plant.
- Wastewater Treatment Processes - total regionalization of the treatment plant siting component would involve selection of a more space-conservative treatment process than stabilization lagoons since neither existing lagoon system is large enough to handle the entire study area's projected wastewater flows and load by itself. If the existing lagoon system is kept in service, then the effluent clarification units, considered necessary for stream discharge options, could be regionalized.
- Effluent Disposal - total regionalization of treatment plant sites and regionalization of effluent clarification units would necessarily regionalize effluent disposal. Alternatively, regionalization of effluent disposal by complete retention or agricultural irrigation is not dependently linked to other functional components except for reasons of economy (for instance, providing activated sludge treatment prior to complete retention would be a waste of public money).
- Sludge Handling and Disposal - the volumes of sludge expected to be generated by the system alternatives

(Section III.B & C) are not sufficient to justify regionalizing sludge handling facilities independently of other functional components. Economies in handling effluent clarification sludges would be easily and necessarily obtained if effluent clarification is regionalized. Joint disposal of sludges, regardless of other regionalization opportunities, should depend primarily on the acceptability of existing sanitary landfills for receiving sludges. (See Section III.C.6).

The primary motive for implementing any regionalization alternative would be potential cost advantages realized from treating wastes in larger units. Nearly all waste processing units are less expensive (per gallon or pound treated) to buy and operate as the capacity of the unit is increased. An example of such "economy of scale" is illustrated in Figure III-6. Obtaining such economy of scale often involves additional purchase or operational costs, however, related to water or solids transport. An example of increased transport cost partially offsetting economies of scale is provided in the regionalization alternative, below, which assumes joint clarification of lagoon effluents prior to stream discharge. Savings accrue to both Gering and Scottsbluff (and Terrytown, if included) due to the need for only one building to house clarification and sludge dewatering equipment, reduced total manpower required to operate the units, and reduced capital cost (per unit capacity) for the manufactured units. Additional costs accrue due to increased size of a pumping station to transport effluent, increased electrical costs for pumping and the cost of a force main constructed under the North Platte River.

To examine the net cost savings that may be obtained through various

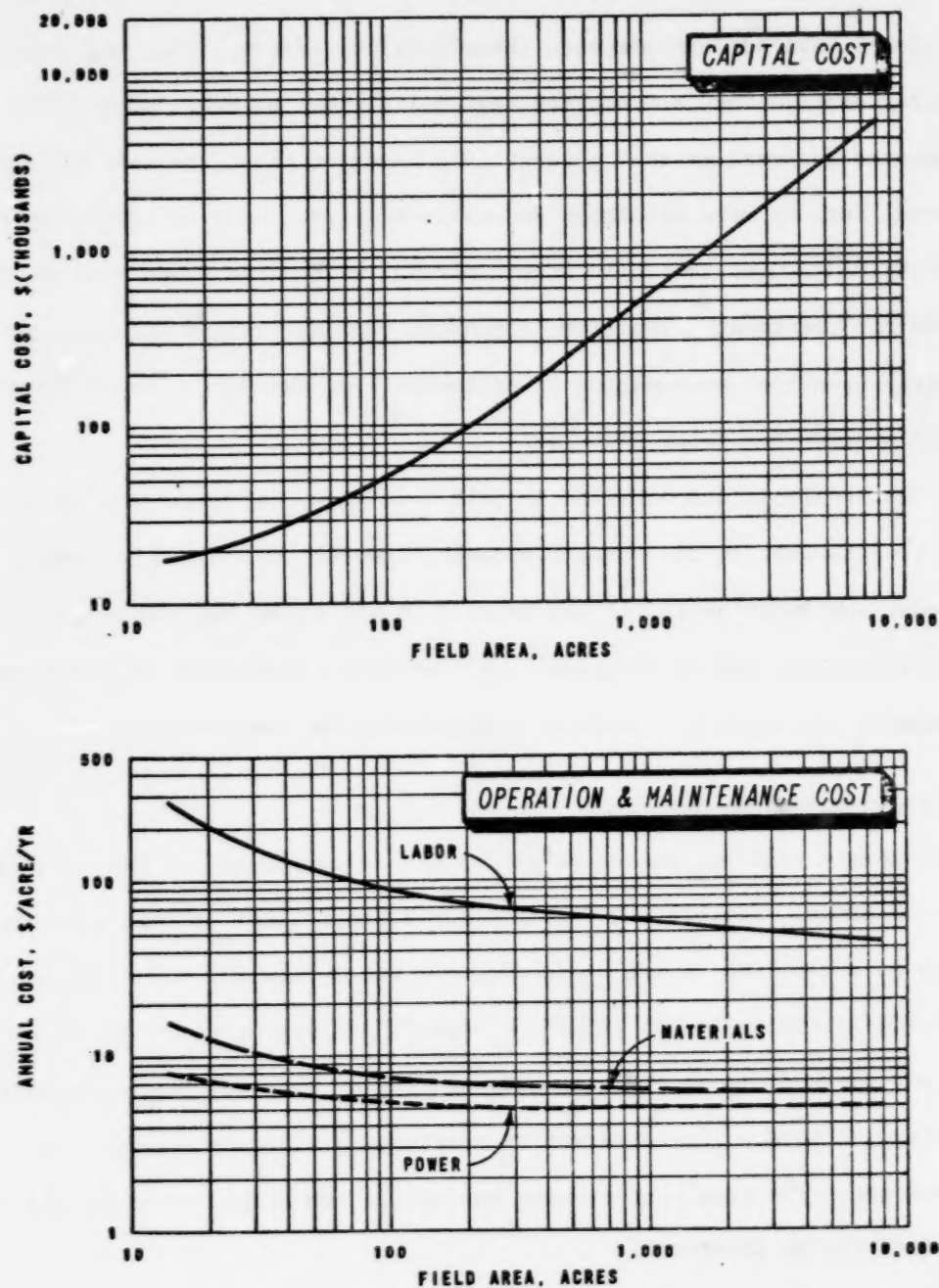


Figure III-6. Example of Economies of Scale. Curves show relevant costs for water distribution by center pivot spraying.

regionalization alternatives, and to provide a basis for evaluating any additional environmental impacts (beneficial or adverse) that may result from regionalization, a "complete regionalization" alternative and three "component regionalization" alternatives based on the three main effluent disposal options were developed and evaluated. The complete regionalization alternative assumes that all three municipal wastewater flows will be collected for treatment. The three component regionalization alternatives primarily consider combination of effluents from the Gering and Scottsbluff lagoon systems for joint disposal.

Cost analysis not detailed in full here show that inclusion of Terrytown's wastewater in the three component alternatives or in the system alternatives (Section III.C) has negligible effect on the relative cost-effectiveness of the alternatives. The optimal disposition of Terrytown's wastewater is, therefore, discussed separately in this section.

1. Complete Regionalization

Complete regionalization precludes the continued use of the existing lagoon systems. Neither the Gering nor the Scottsbluff systems are large enough to accept the entire projected wastewater flow for the study area. Enlarging either system to treat the other's wastewater would result in taking new land for additional lagoons while abandoning existing lagoon acreage. Therefore, a more space-conservative treatment process is assumed for this alternative. The treatment process assumed is two-stage, complete mix activated sludge treatment.

No new land would be taken for siting the plant. Adequate space is available at either of the two existing lagoon systems to accommodate a regional activated sludge plant. Regrading of either site would be desirable. Because the influent end of the Scottsbluff lagoon system is the most

downstream point of wastewater flow concentration in the study area, this is the logical site for a regional facility.

In developing costs for the complete regionalization alternative, the assumption is made that no pretreatment by the meat packing plants will be provided.

Extensions of the existing sewage collection systems would be necessary for complete regionalization. Terrytown's wastewaters would be transported across the Nebraska Highway 71 bridge to the Scottsbluff interceptors. Gering's industrial and domestic wastewaters would be mixed and transported to the Scottsbluff interceptor through a force main attached to the new bridge planned by the Scotts Bluff County Board of Commissioners to cross the North Platte River just east of the Gering plant. The airport sewer would be rerouted, as discussed in the Scottsbluff Facilities Plan, to the headworks of the regional plant.

Because state effluent limitations require seasonal reductions in effluent ammonia concentrations, the regional plant would have a second activated sludge unit to effect nitrification of the wastewater. No chlorination of the effluent is proposed since chlorine could adversely affect the aquatic biota of the North Platte.

Effluent disposal would be by stream discharge to the North Platte. Inclusion of a regional treatment plant in any alternative which also incorporates complete retention is not reasonable since treatment efficiency is not a factor in design or operation of complete retention alternatives. Agricultural irrigation in conjunction with a new regional treatment facility is not considered since adequate reduction of suspended solids and BOD for irrigation can be achieved at a much lower cost with moderate upgrading of existing lagoon systems.

The component options and estimated costs of the complete regionalization alternative are summarized in Table III-13.

2. Joint Effluent Clarification and Algae Sludge Processing

All of the system alternatives which included the option of stream discharge also included effluent clarification plus dewatering and landfill of the resultant sludge. Net cost savings might be realized by providing these processes at a single location instead of at both lagoons. Selection of a site for the joint units would depend upon the choice of applicable wastewater treatment processes in Gering (acquisition of land for new stabilization lagoons in Gering would facilitate siting of the joint units on part of that site) or on the availability of other small tracts near the existing lagoon systems. No assumptions are made concerning unit siting for this alternative. Overall length of the force main connecting the two wastewater flows is assumed to be 6,000 linear feet.

The effluent clarification process selected for consideration in the system alternatives was dissolved air flotation with chemical additions (see Section III.B.5 and Appendix K). The basis for selection of DAF over microscreening was that DAF has proven reliability with many types of suspended solids, whereas microscreening may not provide suitable results under some conditions. The present worth (over 20 years) of cost savings attributable to substituting microscreening for DAF in this regionalization alternative is estimated to be one-half million dollars. Long-term (one year) pilot plant studies would be desirable to determine the effectiveness of microscreening.

For comparison to system alternatives, the industrial pretreatment and wastewater treatment process options for this regionalization alternative are the same as those in Gering - SD 1 and Scottsbluff - SD 3.

Table III-13

Component Options-Regional Alternatives

Identification	Industrial Pretreatment	Collection System	Treatment Plant Siting	Wastewater Treatment Processes	Effluent Disposal	Sludge Management	Costs Present Worth (x \$100M)	Overall Project Cost Code (x 1000 gal)
COMPLETE REGIONAL ALTERNATIVE								
RSD1	Scottsbluff-none Gering-screening & DAF	Wastes from Gering across planned 21st Ave. bridge to Scottsbluff. Wastes from Terrytown across Broadway Ave. bridge.	Fill and regrade Scottsbluff lagoon site to locate new treatment plant.	Two-stage, complete mix activated sludge treatment	Steam Discharge	Sludge diges- tion, vacuum filtration landfill or land application	\$11,195	49.50¢
JOINT EFFLUENT CLARIFICATION AND ALGAE SLUDGE PROCESSING								
RSD2	Three major meat packing indus- tries provide screening DAF	--	Location of clarification unit not yet selected Terrytown-wastes to be treated at Scottsbluff lagoons.	Scottsbluff-Add aerated lagoon, up- grade flow distribu- tion to 4-1-1 con- figuration. Gering-Existing facilities for treating industrial and domestic wastes. Joint effluent clarifica- tion by DAF with chemical additions.	Steam Discharge	Sludge diges- tion, vacuum filtration landfill or land application	\$8,464	37.42¢
JOINT EFFLUENT DISPOSAL BY COMPLETE RETENTION								
RSD3	Scottsbluff-none Gering-screening & DAF	--	Scottsbluff-existing lagoon for Gering-existing lagoon for industrial waste Terrytown-wastes to be treated at either Scotts- bluff or Gering	Scottsbluff-upgrade influent distribution to 4-1-1 config. Gering-industrial in existing lagoon, route domestic and any industrial effluent to complete retention pond	Complete Retention	Not necessary	\$12,350	54.60¢

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Table III-13 - Cont'd.

Identification	Industrial Pretreatment	Collection System	Treatment Plant Siting	Wastewater Treatment Processes	Effluent Disposal	Sludge Management	Present (North)	Future (South)	Total (North + South)
JOINT EFFLUENT DISPOSAL BY COMPLETE RETENTION (continued)									
RCRS	Scottsbluff-none Gering-screening & DAF	--	Scottsbluff-existing lagoon Gering-existing lagoon for industrial waste Terrytown-wastes to be treated at either Scotts- bluff or Gering	Scottsbluff upgrade influent distribution to 4-1-1 config. Gering-industrial in existing lagoon, route domestic and any industrial effluent to complete retention pond	Complete Retention South Site	Not necessary	\$10,243	46,69¢	
RCRV	Scottsbluff-none Gering-screening & DAF	--	Scottsbluff-existing lagoon Gering-existing lagoon for industrial waste Terrytown-wastes to be treated at either Scotts- bluff or Gering	Scottsbluff-upgrade influent distribution to 4-1-1 config. Gering-industrial in existing lagoon, route domestic and any industrial effluent to complete retention pond	Complete Retention Valley Site	Not necessary	\$7,564	33.43¢	
JOINT EFFLUENT DISPOSAL BY AGRICULTURAL IRRIGATION									
RAIN	Scottsbluff-none Gering-screening & DAF	--	Scottsbluff-existing lagoon plus 10 acres Gering-industrial treatment in existing lagoons, new 120 acre site for domestic stabi- lization lagoon Terrytown-wastes to be treated at either Scotts- bluff or Gering	Scottsbluff-Add aerated lagoon, upgrade influent distribution, collect lagoon overflow, chlorinate Gering-continue indus- trial, and domestic wastetreatment in existing lagoons, chlorinate	Agricultural Irrigation North Site		\$12,199	53.93¢	
RAIS	Scottsbluff-none Gering-screening & DAF	--	Scottsbluff-existing lagoon plus 10 acres Gering-industrial treatment in existing lagoons, new 120 acre site for domestic stabi- lization lagoon Terrytown-wastes to be treated at either Scotts- bluff or Gering	Scottsbluff-Add aerated lagoon, upgrade influent distribution, collect lagoon overflow, chlorinate Gering-continue indus- trial, and domestic waste treatment in existing lagoons, chlorinate	Agricultural Irrigation South Site		\$10,853	47.98¢	

Location System	Treatment Plant Siting	Wastewater Treatment Processes	Effluent Disposal	Sludge Management	Costs	
					Present Worth (x \$1000)	Overall Treatment Cost (c/1000 gal)

A. AGRICULTURAL IRRIGATION (continued)

Scottsbluff-adding-irrigation	Scottsbluff-existing lagoon plus 10 acres Gering-industrial treatment in existing lagoons, new 120 acre site for domestic stabilization lagoon Terrytown-wastes to be treated at either Scottsbluff or Gering	Scottsbluff-Add aerated Agricultural lagoon, upgrade influent Irrigation distribution, collect lagoon overflow, chlorinate Gering-continue industrial, and domestic waste treatment in existing lagoons, chlorinate			\$11,376	59.13c
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3. Joint Effluent Disposal by Complete Retention

Any cost savings resulting from this regionalization alternative compared to system alternatives using complete retention would be attributable to elimination of duplication of wastewater transport facilities. In the case of complete storage lagoons at the North and South sites, this cost savings would be substantial. Moderate cost savings from regionalization of complete retention compared to systems alternatives using a single Valley site, however, are substantially offset by the additional cost of a force main river crossing.

The wetted acreage necessary for a new joint complete retention lagoon at either site is presented in Table III-14. Since the acreage needed is linearly related to total average wastewater flow, no cost savings is expected to accrue from savings in land costs. Availability of sufficient acreage of the three sites is assumed for this regionalization but has in no way been verified.

4. Joint Effluent Disposal by Agricultural Irrigation

As with complete retention, the costs savings from joint effluent disposal by agricultural irrigation would result from reduced effluent transport costs. Since the same three sites are considered, the transportation cost savings would be the same for each site considered as in the regionalized complete retention alternative. Again, the availability of sufficient acreage for storage lagoons and irrigation plots is assumed but not verified. The acreages required are shown in Table O-2.

Cost comparisons and component options for the three regionalized effluent disposal alternatives are shown in Table III-13.

Table III-14

Acreage of Complete Retention Ponds Needed
for Various System and Regional Alternatives

Alternative	Design Flow (mgd)	With Percolation of 1/8"/day			Without Percolation		
		Total Wet Acres ^a	New Wet Acres	Total New Acres ^b	Total Wet Acres ^a	New Wet Acres	Total New Acres ^b
A All three	5.85	842	673	808	1653	1484	1781
With reduced infiltration ^c	5.47	787	618	742	1545	1376	1651
B Scottsbluff and Terrytown	3.47	499	376	451	980	857	1028
With reduced infiltration ^c	3.09	445	322	386	873	750	900
C Gering and Terrytown	2.63	378	332	398	743	697	836
D Scottsbluff	3.22	463	340	408	910	787	944
With reduced infiltration ^c	2.84	409	286	343	802	679	815
E Gering	2.38	342	296	355	672	626	751

^a Total wet acres includes existing lagoons plus new complete retention pond.

^b Total new acres includes new wetted acres plus 20% additional land for buffer strip.

^c Assumes infiltration reduced from 0.55 mgd to 0.17 mgd at Scottsbluff.

5. Feasibility and Cost Comparisons of Including Terrytown's Wastewater in System and Regionalization Alternatives

Terrytown's wastewater flows and pollutant loads are small compared to Gering's or Scottsbluff's. Should Terrytown's wastewater be combined with Gering's and/or Scottsbluff's for treatment or disposal, the incremental increases in significant design parameters for various system and regionalization alternatives are small as shown in Table III-1 . The only incremental increase of significance to the feasibility of the many alternatives would be the increased lagoon BOD loading for system alternative Scottsbluff -S.D.4. The estimated year 2000 loading in that alternative without Terrytown is already above the State of Nebraska design limit of 25 lb/acre-day. Approval of the high loading, with or without Terrytown contributing, would be a matter for State review of the complete systems described.

Another potential problem with transporting Terrytown's wastewaters to Scottsbluff is the hydraulic capacity of the interceptor that would carry the additional flow. Peak daily depth of flow in this 24-inch-diameter sewer was recently measured at 12.5 inches. Only 40 to 50 percent of the available capacity is, therefore, being used at present. However, growth and combined sewer flows will use some of the remaining capacity. In order to assure capacity for Terrytown, it is assumed that the concrete, combined sewer serving Broadway Avenue in Scottsbluff would have to be converted to a storm sewer only by installing a new sanitary sewer, with connections, severing existing connections to the concrete sewer, and extending the concrete sewer for discharge to the North Platte River. The total cost for replacing the combined sewer is estimated to be \$150,000.

Treatment of Terrytown's wastewater at Gering's, Scottsbluff's, or a regional facility is feasible. Inclusion of Terrytown's wastewaters with that of the other municipalities would make an insignificant difference in

cost-effectiveness for Scottsbluff or Gering. The decision to transport Terrytown's wastewaters to Gering or Scottsbluff should, therefore, be based upon cost-effectiveness to Terrytown.

The total capital costs, design year operation and maintenance costs, and overall treatment cost per 1,000 gallons at design flow for the system and regional alternatives open to Terrytown are tabulated in Table III-15. Service charges to Terrytown for treatment at Scottsbluff or Gering are assumed to be \$.09 per 1,000 gallons. This cost is based upon the lowest local cost to treat available to Scottsbluff or Gering (see Table III-21) plus a small addition for administrative costs. The most cost-effective solution, T.2 - Modify Existing Plant, assumes that sludge handling and disposal service can be provided elsewhere at a nominal cost.

E. IMPACTS OF ALTERNATIVES AND COMPONENT OPTIONS

Engineering and cost-effective considerations as well as recognition of environmental and regulatory goals were the essential factors used to select options and alternatives for more detailed consideration. The environmental evaluations that have been made for the numerous alternatives are organized by environmental categories (water quality, health effects, etc.)

1. Surface Water Quality Impacts

Water quality impacts of the system and regional alternatives can be described in four categories: (a) non-point pollutant loads generated by construction activities, (b) non-point pollutant loads from operation of agricultural irrigation options, (c) point source pollutant loads generated by stream disposal options and (d) nutrient loadings to Lake McConaughy.

Table III-15

Terrytown Alternative Costs

<u>Alternative</u>	<u>Total Capital Cost</u> \$1,000	<u>Design Year O&M</u> \$1,000	<u>Design Year Cost</u> c/1,000 gal.
T.2 - Modify Existing Plant; Sludge Digestion and Disposal by Scottsbluff	32	23	28.5
T.2.G. - Transport to Gering for Treatment and Disposal	204	11	31.2
T.1.G. - Transport to Scotts- bluff for Treatment and Disposal	253	10	36.2
T.3. - Modify Existing Plant Including Aerobic Sludge Digestion and Sludge Drying Beds	119	25	39.6

a. Non-point Pollutant Loads Generated by Construction Activities

The major water pollutant generated on construction sites is sediment. Other potential pollutants associated with construction include pesticides, petrochemicals, solid wastes, chemicals, wastewater, garbage, cement, lime, sanitary wastes, and fertilizers (EPA, 1976a). Except for sediment, discharge of these materials can be minimized by appropriate site hygiene, spill, and debris control. Water transport of sediment from disturbed soil areas would be most likely to occur during the summer when intense thunderstorms occur.

Construction activities which have the highest potential for discharge of non-point pollutants are lagoon and storage pond construction, grading agricultural irrigation acreage, regrading the Scottsbluff and Gering lagoons, and river crossings. Construction of complete retention lagoons or storage ponds at either the North or South sites would require massive earth-moving efforts because of topography. The high potential for sedimentation from these sites can be mitigated by conventional physical control measures such as sedimentation basins with gravel weirs and staked hay bales. The potential for sedimentation from a complete retention lagoon at the valley site or from storage ponds at the valley irrigation site is small due to flat topography and slow surface runoff.

Regrading of irrigation acreage in the valley areas would probably not be necessary except for development of surface runoff control berms and ponds. Grading of the North and South site acreage to accommodate center pivot equipment could involve considerable disruption of the soil and significant potential for sedimentation. However, this potential can be avoided by prior construction of runoff control berms and ponds.

Regrading of the Scottsbluff and Gering lagoons in alternatives which include phasing them out has significant sedimentation potential due to large acreages involved, proximity to the North Platte and large volumes of organic lagoon sediment. Rigorous on-site sediment control measures will reduce the sedimentation hazard.

Force main crossings of stream and river channels would be necessary for various alternatives using the North or South sites for effluent disposal. Stream crossings would be necessary for the following transport options:

<u>Origin</u>	<u>Disposal Site</u>	<u>Stream Crossings(s)</u>
Scottsbluff Lagoons	North Site	Winters Creek at Rt. 26
Scottsbluff Lagoons	South Site	North Platte River south of Lagoons 5 & 6; Gering Drain south of Lagoons 5 & 6.
Gering Lagoons	South Site	Gering Drain at undetermined location.

The North Platte River crossing and possibly the Winter's Creek and Gering Drain crossings would require Section 404 permits from the Corps of Engineers. Winter's Creek and Gering Drain could be tunneled underneath for the crossing with limited surface soil disruption and sedimentation.

Several subgrade crossings of the North Platte can be avoided by supporting force mains on existing or new bridges. Several irrigation canals will also be crossed by force mains but scheduling construction for non-irrigation periods will effectively eliminate impacts on canal operation or water quality.

Sedimentation from construction activities would be short-term. Water quality and river bed characteristics would revert quickly to existing conditions. Potential sediment loads to the North Platte are greatest with regrading of the Scottsbluff and Gering lagoons but, even in this case, the increase over the existing sediment load carried by the river would be negligible. Locally significant sedimentation along force main routes and at effluent disposal sites can be avoided by sound construction management.

Non-point pollutant loads generated by construction activities are not considered to be determinative in selection of regional or system alternatives.

b. Non-point Pollutant Loads from Operation of Agricultural Irrigation

Options

Application of treated wastewater to soils has the beneficial effect of removing suspended solids, dissolved organics, microorganisms, heavy metals and phosphorus with high degrees of efficiency. Filtration, adsorption, ion exchange and, possibly, precipitation are the mechanisms for these removals. Accumulation of the wastewater constituents, especially suspended solids and microorganisms, will be greatest at the soil surface where they will be most susceptible to entrainment in surface runoff along with sediment. The potential exists for increased concentrations of wastewater pollutants in surface runoff, for increased likelihood of surface water runoff and for increased quantities of runoff from the North and South sites due to irrigation. The likelihood of runoff from a valley site should not change since the site would already be irrigated.

Runoff occurs when the rate of rainfall exceeds the infiltrative capacity of the soil. Infiltrative capacity is governed by the conditions of the soil surface and the physical characteristics of the soil. Changes in the soil which could result from agricultural irrigation and cause increased frequency and quantity of runoff are compaction of the soil surface and increased initial moisture content (above field capacity). Working to increase infiltrative capacity and reduce runoff are increases in soil organic content, minimization of air entrapment and provision of good crop cover (later in the season).

Overall, good soil and crop management will minimize runoff and possible surface water contamination. Positive control of unavoidable runoff by constructing collection berms and storage basins with return to the main storage pond can avoid runoff impacts altogether. Disinfection of lagoon effluents and long storage times will reduce the microbial content of irrigation water and, therefore, of runoff, thereby minimizing water quality and health hazards from surface runoff.

Disposal of drainage water from irrigation acreage also poses a potential threat to surface water quality. Total dissolved solids in water leached through the soil could be as high as 6300 mg/l. Discharge of this water to the ephemeral and small streams near the North or South sites could eliminate any existing freshwater habitat there. If collection of drainage water is necessary to protect groundwater resources, either evaporation ponds or discharge to the North Platte would be necessary.

c. Point Source Pollutant Loads Generated by Stream Disposal Alternatives

The purpose for wastewater facilities planning in the Primary Study Area is that none of the three municipalities has satisfactorily met applicable effluent limitations. Adverse water quality and aquatic biota impacts of these discharges have not been documented, however,. The dissolved oxygen regime of the North Platte appears to be excellent with little or no stress attributable

to the discharges of organic materials in municipal effluents. Significant water quality parameters which appear to be adversely affected now by the discharges are TDS, ammonia and fecal coliforms. Even with the present condition of the municipal plants, however, water quality downstream (McGrew) continues to satisfy current state stream standards for all parameters.

Surface waters affected by operation of the system and regional alternatives are limited to the North Platte River and Lake McConaughy. As discussed above, surface runoff from irrigation of agricultural acreage can be effectively controlled by good agricultural management and on-site collection and reapplication of unavoidable runoff. Land disposal by complete retention or agricultural irrigation could indirectly impact water quality in streams fed by the groundwater which receives drainage or percolating water. This indirect impact is not expected to be of sufficient magnitude to be measurable due to the substantial dilution of drainage or percolating water in existing groundwater reservoirs (This is discussed further in Section III.E.5 - "Groundwater Impacts").

Reductions or increases in the loads of BOD, ammonia, TDS and fecal coliforms discharged to the North Platte are the most significant long-term surface water quality impacts of the various alternatives. The pollutant loads can vary from zero, if land disposal alternatives are implemented for all three municipalities, to design year loads if all three municipalities discharge to the river. Changes in BOD, ammonia, TDS and fecal coliform quantities in the North Platte attributable to various alternatives are discussed below by pollutant.

BOD -- It is assumed for all stream discharge alternatives that a BOD concentration of 30 mg/l is achievable year round. The alternative which has the greatest discharge volume, Complete Regionalization from a 5.85 mgd activated-biofilter plant, would have the greatest design year BOD discharge

load, 1465 lb/day. This compares to an estimated current BOD load from the three facilities of 2000 lb/day. Considering that the BOD/dissolved oxygen regime in the river is presently in excellent condition, the projected BOD discharges would have no adverse impact and would represent an improvement over existing conditions.

Consideration must be given to the possibility of not meeting the 30 mg/l limit seasonally using lagoons for treatment. Especially during and just after periods of ice cover, the lagoon effluents will not be as completely oxidized as during summer months. While DAF units are highly reliable means of removing suspended solids and colloidal organic material, they cannot be expected to remove ammonia and seasonally high concentrations of dissolved BOD. Insufficient operating experience with lagoon-DAF units during ice cover periods has been reported in the literature. Detailed estimates of effluent quality and resulting receiving stream quality cannot be made because of this lack of information. Preventing discharge during these periods could partially avoid this problem, but lagoon retention times for design flows are limited to 38 days for Scottsbluff and 18 days for Gering. In any case, effluent quality from upgraded lagoon-DAF treatment processes would be an improvement over existing conditions.

Ammonia Nitrogen -- State water quality standards for the stream segments in and below the study area are 2 mg/l in the winter (December, January, and February) and 1 mg/l during the rest of the year. The maximum ammonia concentration measured below the study area's discharges (at McGrew) was 0.37 mg/l in January, 1974. Average ammonia concentrations were 0.11 mg/l and the average for three samples taken during low-flow conditions was 0.02 mg/l. Existing discharges do not contribute to violation of stream standards according to available data.

Local impacts in the mixing zones may be significant, however. Ammonia concentrations in Gering's and Scottsbluff's lagoon effluents reach 20 to 25 mg/l in cold weather. Discharge of all wastewater from the study area in design year, 5.85 mgd, during 7-day, 2-year low flow conditions 168 cfs, would provide a dilution ratio of 20:1. (The probability of this flow occurring during cold weather is not known) After mixing, the incremental increase in ammonia would be 1.3 mg/l which would still be within state standards. Within the mixing zone during worst-case conditions, however, concentrations would vary from 1.3 to 25 mg/l. State standards permit elevated concentrations in the mixing zone. The mixing zones below the three discharges are expected to be short due to high velocity of the river so that the areal extent of seasonally high ammonia concentrations will be limited.

During warm-weather lagoon-DAF operation, ammonia concentrations should not exceed 5 mg/l. Since discharge during extreme low-flow conditions can be avoided by storing effluent in the lagoons, the 7-day, 2-year low flow would represent a realistic worst-case situation. At this flow, 168 cfs, and an ammonia concentration of 5 mg/l, the incremental increase in ammonia below the mixing zone at design flow would be 0.25 mg/l. Considering that background concentrations are on the order of 0.02 mg/l, the total concentration under worst-case conditions would still be within standards. Reduced organic loadings on the lagoons in both Gering and Scottsbluff and prevention of short-circuiting in Scottsbluff's lagoons should reduce discharges of ammonia below present levels.

Because of long retention times, lagoons that are not organically overloaded nitrify (convert ammonia to nitrates) when water temperatures rise with air temperatures. Conventional activated sludge plants that have short hydraulic and solids retention times may nitrify only briefly in the summer

or not at all. Ammonia concentrations can remain high year round. For this reason, the wastewater treatment processes in the Complete Regionalization alternative and in Scottsbluff Alternative S.D. 1. include a nitrification step consisting of a second activated sludge unit in series with the activated bio-filter system. This additional nitrification step may not be necessary pending operational scrutiny of the nitrification capabilities of an installed activated bio-filter plant.

Total Dissolved Solids -- U.S.G.S. monitoring records (See Section II. F.2) show that average TDS concentrations increase by nearly 100 mg/l from the state line (517 mg/l) to McGrew (612 mg/l). Maximum concentrations were 681 mg/l and 684 mg/l. Some fraction of this increase is attributable to wastewater discharges. TDS concentrations in raw wastewaters in the study area are on the order of 1200 mg/l. High dissolved solids concentrations in groundwater which serves as the water supply (700 mg/l), brine used to regenerate water softening units, rock salt used on the floors of meat packing plants and sanitary wastes contribute to this high TDS concentration. Large stabilization lagoons and high evaporation rates concentrate the solids to 1300-1500 mg/l so that the TDS concentrations of the lagoon effluents are approximately twice as high as concentrations in the river. The estimated TDS load presently being discharged is estimated to be 39,500 lb/day. At design flows this load will increase to 55,200 lb/day if all three municipalities continue to discharge to the river. Addition of alum in conjunction with DAF of lagoon effluents could add an additional 100 mg/l, or approximately 5000 lb/day of solids for the joint effluent clarification regional alternative. The maximum incremental increase in downstream TDS concentration would be 85 mg/l at the 7-day, 10-year low flow, 23 mg/l at the 7-day, 2 year low flow, and 5 mg/l at the average August flow. (Minatare stream gauge records). Considering that discharges could be reduced or stopped

altogether during critical periods, the greatest increase that needs to be evaluated is the 23 mg/l figure associated with full discharge during 7-day, 2-year flows. Added to the recent maximum of 684 mg/l measured at McGrew, maximum TDS in the design year using worst-case assumptions would be 707 mg/l, a 3 percent increase over existing conditions. This is well within the recently enacted state stream standard of 900 mg/l for total dissolved solids. This standard has been reviewed and approved by the Nebraska State Department of Fish and Wildlife. The standard is still subject to public review and comment and is being evaluated in an EPA-sponsored study that is not yet complete.

In regard to the improvement in river TDS concentrations resulting from elimination of stream discharges, change in mean concentrations at mean discharge is the appropriate comparison instead of worst case analysis. Mean discharge at Minatare is 1,130 cfs. The 39,500 lbs TDS currently discharged represents only 2.7 mg/l at mean flow or less than one half of one percent of the current TDS concentrations. Removal of the municipal discharges would have negligible impact on TDS concentrations in the North Platte River.

TDS loads discharged to the North Platte River have minor impacts because of the high dilution ratio afforded. A similar advantage is not available for drainage from spray irrigation at the North and South sites. The potential for needing underdrainage derives from very high TDS concentrations in drainage water and the need to protect local groundwater supplies. The maximum TDS concentration in the drainage water is estimated to be 6300 mg/l. Disposal of this drainage water would have to be by some other means than stream discharge since suitable streams are not available near these sites. Underdrainage from a valley site would not pose as serious a problem since direct discharge to the North Platte would be feasible.

Fecal Coliforms -- The State of Nebraska has indicated informally to Bell, Galyardt and Wells that Gering and Terrytown will not be required to disinfect effluent discharged to the North Platte River, subject to a public hearing on the issue after which a final decision will be made. The intent of this action by the State is to protect rainbow trout in the river from adverse effects of chlorine residuals by allowing municipal wastewaters to be discharged without chlorination. For the purposes of this report the assumption is made that Gering and Terrytown as well as Scottsbluff will not be required to disinfect wastewater effluents in stream discharge options.

For those system alternatives at Scottsbluff and Gering utilizing lagoon treatment, upgrading of the lagoons will decrease levels of fecal coliforms in the lagoon effluent compared to existing levels. However, due to the many factors involved in the treatment process it is difficult to predict the amount of coliforms in the effluent from the lagoons. Population increases to the year 2000 will contribute additional bacteria to wastewater flows and may offset decreases in bacteria levels due to operational improvements.

Treatment of wastewaters by the activated sludge and activated bio-filter processes should result in higher levels of bacteria in the effluent than with lagoon treatment due to the fact that these processes do not provide the longer detention times available in the lagoon systems. The advantage with long detention times is that bacteria die off in a time dependent manner.

Available effluent sampling data does not include fecal coliform analysis and no stream sampling data is available near the existing outfalls. Accurate analysis of the effects of removing, reducing or increasing these sources of sewage bacteria is not possible. The relative contribution of study area municipal sources compared to other municipal sources, feedlots and other surface sources also cannot be established.

The only available index to fecal coliform concentrations in the North

Platte are U.S.G.S. monitoring records at the state line and at McGrew, which is approximately 10 miles downstream from the Scottsbluff lagoon discharges. Concentrations at the state line are moderate and represent a baseline condition. The geometric mean for 44 samples collected between June, 1973 and August, 1976 was 80 organisms per 100 ml. The geometric mean for 39 samples at McGrew over the same period was 422 representing degradation of water quality to partial body contact standards. The McGrew data indicates that the partial body contact standard now in force for these stream segments is not violated, however.

d. Nutrient Input to Lake McConaughy

The sediment and nutrient inputs to Lake McConaughy contribute to its gradual eutrophication. Increases in sediment and nutrient inputs caused by man's activities accelerate the aging process. The average sediment and nutrient loads carried by the North Platte River past McGrew, the loads presently discharged from the municipalities in the study area, projected loads (assuming all study area wastewater is given lagoon-DAF treatment and all meat packing wastes are screened and DAFed), and relevant percentage contributions are presented in Table III-16.

2. Surface Water Quantity Impacts

Projected waste flows in stream discharge alternatives range from the smallest single flow, Terrytown, to the combined discharges of all three towns. Waste flows for these alternatives range from .25 MGD to 5.85 MGD respectively. (if upgraded lagoon systems in Gering and Scottsbluff are used, net evaporative/rainfall losses in the lagoons need to be considered, and the average design year discharge flows reduce to 2.14 MGD for Gering alone and 4.95 MGD for all three towns.) The estimated combined effluent flows for all three towns which are presently discharging to the North Platte River is 3.12 MGD.

The impact of the alternative disposal options on water quantity will be

Table III-16

Sediments and Nutrient Inputs to Lake McConaughy
Total, Existing Municipal and Projected Future Municipal-

All Municipalities Using Lagoon -
DAF Treatment with No Industrial Pretreatment

	Present Total	Existing Municipal Loads		Future Municipal Loads	
	<u>Loads</u> <u>(lbs/day)</u>	<u>(lbs/day)</u>	<u>(% of Total)</u>	<u>lbs/day)</u>	<u>(% of Total)</u>
Sediment (Suspended solids)	5.3×10^6	2.1×10^3	.04	1.5×10^3	.03
Total Nitrogen	2.0×10^4	1.1×10^3	5.5	1.0×10^3	5.0
Total Phosphorus	3.2×10^3	231	7.2	50	1.6

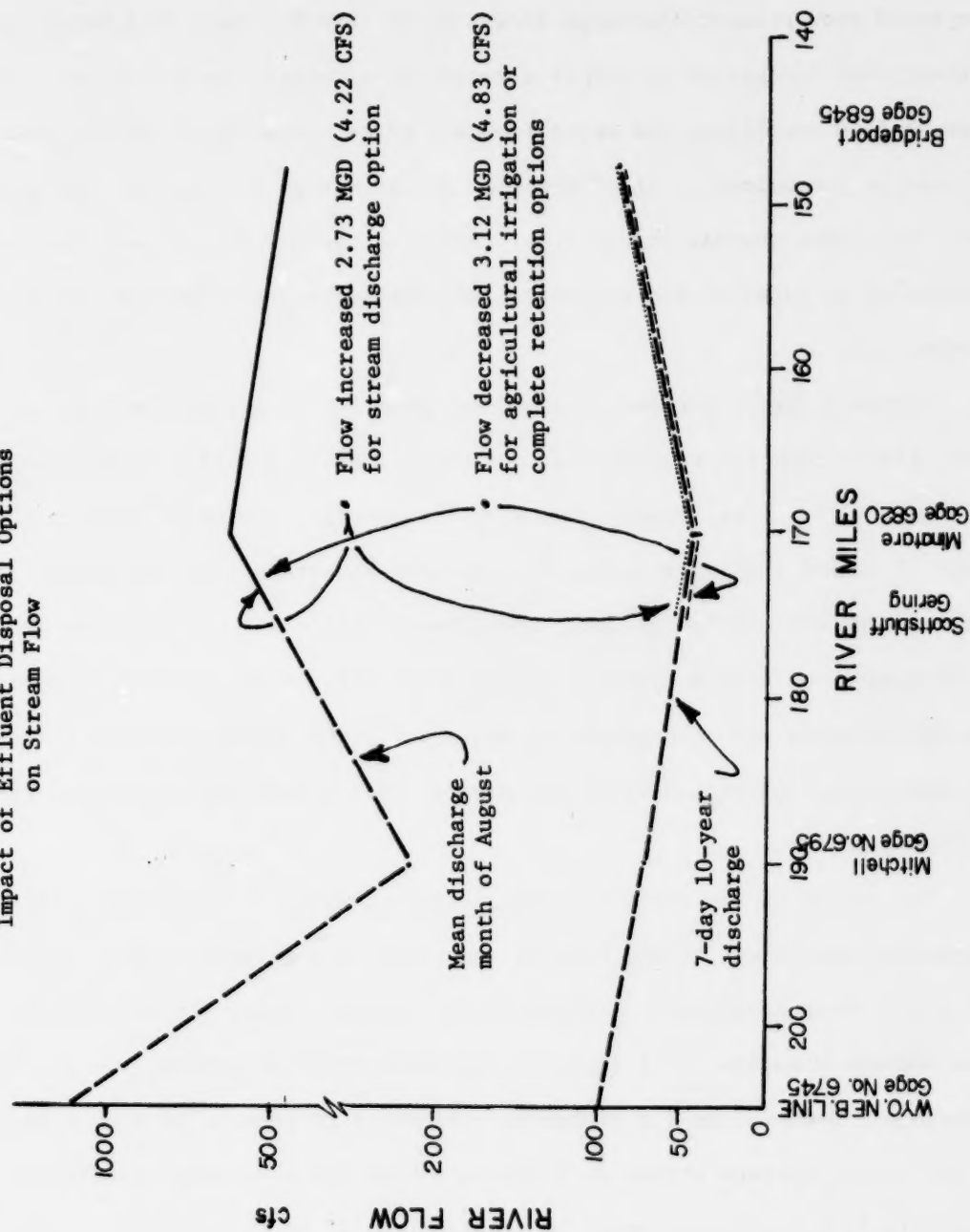
to either supplement the flow of the North Platte River by the increase of projected over present discharge flows, or to remove present discharges if agricultural irrigation or complete retention alternatives are chosen. Under average flow conditions the waste from all three towns in the design year represents approximately 1% of the flow in the stream for August, the month with the lowest average stream flow. However, under 7-day 10-year low flow conditions to total projected waste flow represents approximately 17% of the stream flow.

Effluent discharges and stream flows recorded at gaging stations on the North Platte from the Wyoming-Nebraska state line to Mitchell have been plotted in Figure III-7. The figure shows that for average flow conditions in the month of August the river losses flow between the state line and Mitchell and between Minatare and Bridgeport. The primary reason for the decrease in flow is diversions of stream flow for agricultural irrigation, although evaporation and infiltration also contribute to the loss. From Mitchell to Minatare runoff and irrigation return flows are greater than stream losses and the river increases in flow.

The impact of the stream discharge options would be to increase the wastewater supplement to the flow of the river by a maximum of 4.22 cfs if all three towns discharged as shown in the figure. Since the river loses flow between Minatare and Bridgeport, supplementation of stream flow may be desirable. However, as the wastewater discharge represents at most only 1% of the August average stream flow the impact of the wastewater discharges on long-term flow conditions would be negligible. If an agricultural irrigation or complete retention disposal option is chosen, the impact would be to decrease stream flow by 4.83 cfs, the estimated existing discharge from the three towns. Again, since the discharge is minor compared to the stream flow, the hydrologic impact of no longer discharging these wastewaters would

Figure III-7

North Platte River
Impact of Effluent Disposal Options
on Stream Flow



be negligible.

The 7-day, 10-year flows show a decrease in stream flow from the Wyoming-Nebraska state line to Minatare, with an increase in stream flow from Minatare to Bridgeport. The discharge of wastewaters under low flow conditions would partially offset the loss in stream flow from Scottsbluff to Minatare as well as supplement low flow conditions in general. The increase in projected over existing wastewater flows represents 9.4% of the 7-day, 10-year stream flow at Minatare. The total projected discharge from all three towns represents 17% of 7-day, 10-year stream flow.

If wastewaters are disposed of by agricultural irrigation or complete retention, 7-day, 10-year stream flow would be decreased 10.7% or 4.83 cfs, the amount of the existing flow.

In conclusion, the combined design year discharges from the three towns would constitute a negligible proportion of the total flow in the North Platte River during average flow conditions. During 7-day, 10-year flow conditions, however, the combined discharges would represent approximately one-sixth of the river flow, partially offsetting diversion and other losses.

3. Flood Plain Impacts

Since the new facilities that are proposed for wastewater collection, effluent transport, and wastewater treatment options are located across and along the North Platte River, the impact of these structures on the flood plain needs to be addressed. The proposed facilities, therefore, have been evaluated in relation to the Intermediate Regional Flood (frequency of occurrence of once in 100 years). Following is a description of those proposed facilities that will infringe on the flood plain and the expected impact on the flooding characteristics of the river.

a. Force Mains

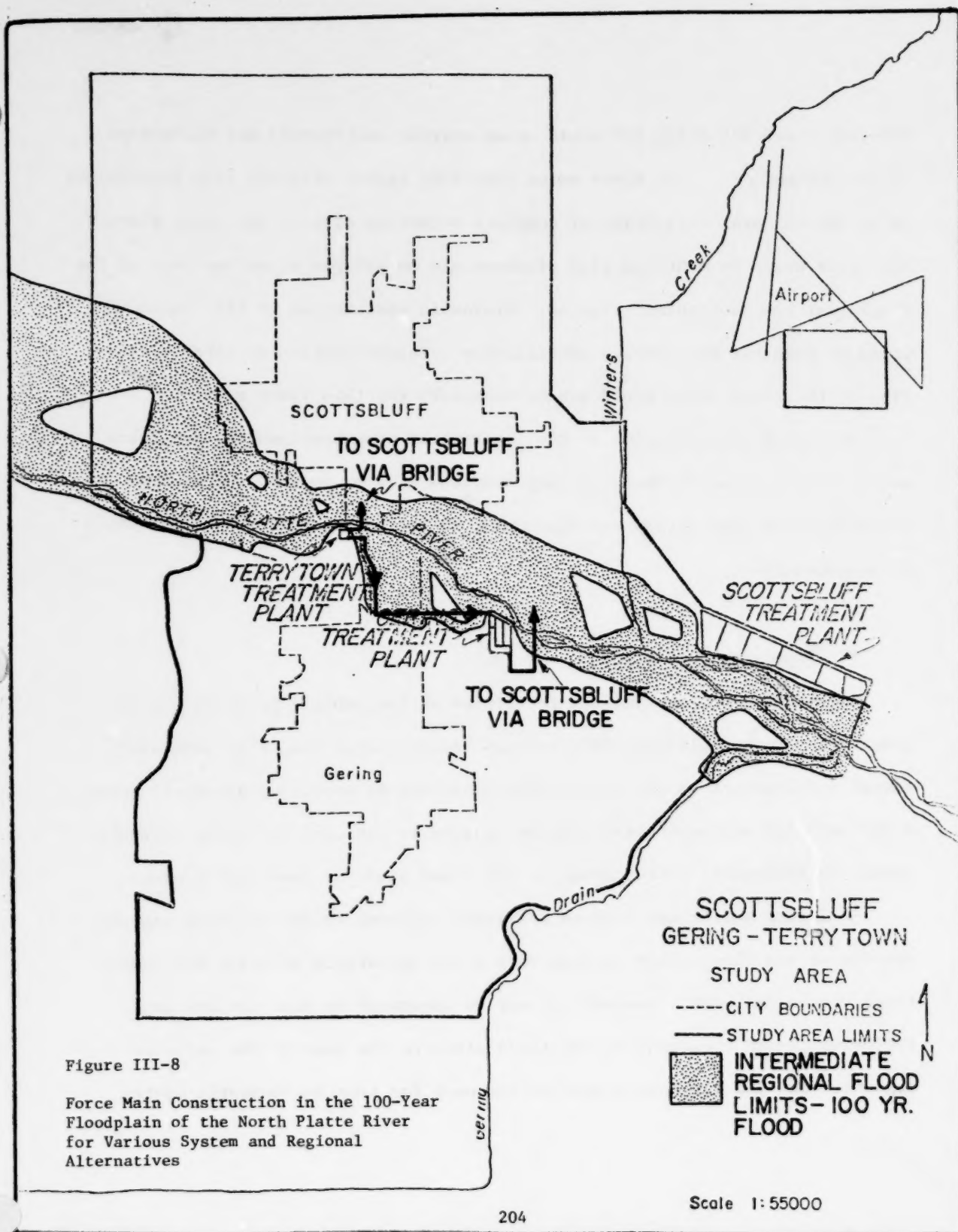
Transportation of wastewaters or effluents from one side of the river to the other for various alternatives will involve placing new force mains in the floodplain. This could include the transport of wastes from Terrytown and/or Gering to Scottsbluff for treatment, and the transport of effluent from the three communities to the agricultural irrigation or complete retention facilities at the North, South, or Valley disposal sites. The intermediate (100-year recurrence probability) Regional Floodplain boundary and those tentative transport routes are shown in Figure III-8.

For conveyance of wastewater from Terrytown to the Scottsbluff treatment system a force main is proposed to cross the river along the Broadway Avenue bridge to discharge to an existing sewer under the Beltline. Also shown in Figure III-8 is a tentative route from the Terrytown sewage treatment plant to the Gering lagoons. The proposed route for conveying wastes from the Gering lagoons to Scottsbluff is along the planned 21st Avenue bridge as shown in the figure.

Several of the system and regional alternatives include river crossings by force mains to reach disposal sites. Figure III-8 shows the tentative routes chosen for transport of the effluent.

If a joint DAF unit for treating effluents prior to stream discharge is located on the south side of the river a transport line from Scottsbluff to the site will be needed. However, as the location of the DAF unit has not been selected, transport routes are also not definite.

The force mains to carry wastewater and effluents from Terrytown and Gering across the river will most likely be attached to the bridge structures of the existing Broadway Avenue and planned 21st Avenue bridges. Ductile or cast iron force mains could be anchored to the bridge structures above the



100-year flood elevation and would cause neither obstruction nor disruption of the floodplain. The force mains conveying lagoon effluent from Scottsbluff to an agricultural irrigation or complete retention site on the south side of the river would be a buried line as there are no bridges along the part of the river near the Scottsbluff lagoons. Hydraulic obstruction of the floodplain would be possible only during installation. Channelization or other alteration of the flood plain would not be necessary for this force main.

A related consideration is the location of pump stations for the force mains. It is expected that the pump stations will be located out of the flood plain so that access and operation of the units would not be prevented by flood waters.

b. Treatment Facilities

The addition of new adjunct facilities at Scottsbluff prior to the lagoons (operations building, DAF, aerated lagoon) would result in some additional infringement on the flood plain amounting to approximately 10-12 acres. A DAF unit for effluent clarification located to the east of lagoon #6 would result in additional infringement on the flood plain of less than 1 acre.

At Gering sufficient land is available adjacent to the existing lagoons outside of the flood plain to construct a new operations building and industrial wastes DAF unit. However, it may be necessary to site the DAF unit following lagoon treatment in the flood plain to the east of the existing lagoons. The new 120 acre stabilization pond for treating domestic wastes

at Gering could be located to the south of the existing lagoons and, therefore, not result in infringement on the flood plain. The City presently owns 80 acres of land south of the existing lagoon system.

A number of system alternatives for Scottsbluff involve only minor changes in the existing treatment lagoons and will not impact the flood plain. Those system alternatives which will not result in any change in the flood plain at Scottsbluff are alternatives CRN, CRS, CRV, and SD4. At Gering, as mentioned, there is sufficient land outside of the flood plain to locate most of the new treatment facilities. All of the Gering alternatives, therefore, except the discharge alternatives (S.D. 1 and S.D. 2) where the final DAF unit may be located in the flood plain, will not result in any changes in the flood plain.

Several of the alternatives will result in less infringement on the flood plain than now exists from the present lagoon systems. Scottsbluff alternative S.D. 1 and regional treatment by a new activated biofilter facility at the Scottsbluff site could include regrading the lagoons to original contours thus removing them as a flood plain obstruction. Additionally, the regional treatment alternative would permit the Gering stabilization lagoons to be abandoned and regraded. In this case the improvement would be minor since it is assumed here that the industrial lagoons, which border on the flood plain, would be retained.

As is now the case with the existing lagoons, facilities that would be located within the floodplain would be protected from floodwaters by construction of earthen barriers. As a result, the flood plain boundary would be altered and the proposed facilities would actually lie outside of the new flood plain. It is expected that any such earthen barriers would be considered new artificial obstructions according to Scottsbluff and Nebraska floodplain ordinances, and so would require permits prior to construction.

Of the existing and proposed wastewater treatment facilities, the existing

Scottsbluff lagoon system is the largest flood obstruction. The cross-sectional areas of the lagoons within the flood profile has not been calculated but appears to represent a significant hydraulic control during severe floods. As such, its presence is expected to marginally increase flood elevations upstream. Removal of the lagoons, made feasible by conversion of the site to accommodate activated bio-filter treatment processes, might lower expected flood elevations for an unquantified distance upstream. In relation to the flood plain infringement created by the lagoons, additional small acreage diked areas to accommodate add-on treatment units above or below the lagoons would have little impact on flood characteristics of the River.

4. Water Use Impacts

The use or non-use of the municipal effluents varies with the three types of disposal options; agricultural irrigation, complete retention, and stream discharge. In the case of agricultural irrigation the wastewater effluents are reused or recycled on irrigation land. Irrigation land requirements, which vary depending on which towns use this disposal option, are based on crop moisture requirements. The amount of irrigation land used in any alternative is chosen so that all of the wastewater effluent for the year is applied to the land during the growing season.

In the complete retention option the retention pond is sized so that net evaporation loss over the pond surface for the year equals the amount of effluent for disposal. Wastewater effluent, therefore, in this means of disposal is not reused but rather is held in a storage pond until evaporated and returned to the hydrological cycle. Effluent disposal by stream discharge likewise precludes further use of the wastewater, at least in the study area, by discharging the wastewater to the North Platte River. Extensive downstream use of the North Platte River for irrigation will result in indirect reuse of effluents discharged to the river.

It has been assumed here in calculating the design flow for Gering that Swift Co. and Stanke Packing Company will divert their waste cooling water away from their industrial sewers. To the extent that they might recirculate waste cooling water, their total waster usage may be reduced. Otherwise, none of the wastewater treatment alternatives will alter use of groundwater supplied.

Effluent disposal by agricultural irrigation at a Valley site will make an equivalent amount of ditch water available to other farmers. Since local irrigation districts can satisfactorily satisfy water demands at present, increased water availability resulting from such alternatives cannot be counted as a positive benefit.

5. Groundwater

Potential impacts on groundwater quantity and quality may be expected to result from all of the alternatives considered here. The impacts of greatest consequence are those related to effluent disposal. These are discussed below in regard to both effluent disposal methods and sites. Minor adverse groundwater impacts can be expected from continued use of the existing lagoon systems in Gering and Scottsbluff.

a. Agricultural Irrigation

The effluent disposal option which would contribute the greatest water quantity and pollutant load inputs to local groundwaters is agricultural irrigation. As discussed in Section III.B and Appendix L, it will be necessary to leach between 16 percent (for sugar beets) and 33 percent (for corn) of applied irrigation water through the crop root zone in order to limit to acceptable levels the salinity of soil water around the roots. For average

years the depth of drainage water that would have to be leached through the root zone would be about 6 inches for sugar beets and 12 inches for corn (see Table N-2). The effects of the drainage water on groundwater table elevations would be dependent upon the hydraulic transmissivities and available water capacities of the substrate underlying irrigation sites.

The irrigation water constituents which are of concern in evaluating changes in groundwater quality are nitrogen compounds, heavy metals, phosphorus, organic compounds, total dissolved solids, bacteria and viruses. Criteria for these constituents in groundwater are described in Appendix D of "Alternative Waste Management Techniques for Best Practicable Waste Treatment" (EPA, 1975a). Because there is insufficient data to support calculation of the dilution of renovated irrigation waters in existing groundwater volumes and because the Valley and South irrigation sites are close to existing wells, it is assumed here that the constituent levels for Group I groundwater supplies ("Requirements for Water Usable Without Treatment") would have to be met by irrigation waters after precolation through the soil profile and prior to entry into local perched or permanent water tables. No specific limitations are given for phosphorus, viruses or total dissolved solids. EPA is also considering secondary drinking water regulations for color, taste and odor, chloride, copper, foaming agents, iron, manganese, sulfate and zinc. See Appendix B for applicable criteria.

Removal of dissolved and suspended materials from the percolating irrigation water will be effected directly by the soil through which it passes and indirectly by crop uptake. All of the soils in proposed irrigation sites have relatively high hydrogen ion concentrations (pH between 7.0-8.8), substantial amounts of calcium carbonate in their subsoils and fine-textured surface and subsoil horizons (see soil data tables in Appendix F).

Where the depth of these soils are at least five feet, it can be expected that they will effectively remove any heavy metals, phosphorus, organic compounds, suspended solids, bacteria and viruses on a short term (< one year) basis by the processes of precipitation, filtration, adsorption and absorption. Barring a lowering of soil pH or redox potential (anaerobic-aerobic status) any heavy metals should remain complexed with soil particles indefinitely. Based upon influent sewage sampling data presented in the facilities plans, the sorption capacity of these soils would not be taxed by heavy metals. Phosphorus compounds adsorbed on soil particles will be substantially removed from percolating waters and then from the irrigation plot by crop uptake and harvest. Bacteria and viruses should also be substantially removed by filtration and adsorption on soil particles. Unless the groundwater elevations rise to within five feet of the soil surface, pathogenic bacteria and virus retention on the soil should be of sufficiently long duration to effect a nearly complete die off. Conversely, if mounding of the groundwater brings water table elevations near the surface, lateral transport of microscopic organisms can be significant before die-off occurs. Suspended solids, particulate BOD and soluble BOD would also be removed by adequate depths of soil. Lagoon treatment and long-term storage of wastewaters will reduce the organic content of applied irrigation water to levels which can readily be filtered out and oxidized on the well-drained soils found on proposed irrigation sites. Organic overloading of the soils could lower the soil pH and redox potential thereby causing a reduced adsorption capacity for metals and phosphates. However, at a maximum loading rate of 16 lb BOD/acre-day (assuming 70 mg/l BOD and a maximum one inch per day application of irrigation water), no such problems are expected.

The remaining irrigation water constituents of concern are nitrogen and total dissolved solids. The various agricultural irrigation alternatives developed in Sections III,A-D, use hydraulic and nitrogen loading rates that have been revised from those presented in the Facilities Plans to reflect:

- the need to leach total dissolved solids through the root zone of crops
- the effect of nitrogen losses in stabilization lagoons
- the reductions in nitrogen loads caused by screening and dissolved air flotation of major meat packing wastewaters.

As described in Appendix O, the nitrogen loading rates resulting from application of 25 inches/year of treated effluent irrigation water are lower than the 200 lb/acre-year sugar beet uptake rate. Use of this crop would minimize nitrate leaching past the root zone and into the groundwater. Except in the case where Stanko's and Swift's wastewaters are not screened and DAFed, and Gering's treated effluent is used for irrigation with or without Terrytown's wastewater, nitrogen loading rates would be low enough that corn, with an uptake rate of 155 lb/ac-year, would take up more nitrogen than would be applied. Some nitrogen losses to the groundwater may occur when fields are heavily watered to force leaching or in areas where Brule silt stone is fractured under thin soils, thereby allowing short-circuiting of percolating soil water to the groundwater. The average concentrations of nitrate in drainage water from irrigation of agricultural plots are, given proper management and monitoring of irrigation and cropping practices, expected to be well within drinking water standards of 10 mg/l-N. Other species of nitrogen compounds are not expected to be present in the irrigation water to an appreciable extent (Nitrites, NO_2^-) or will not percolate

through most of the area's soils because of adsorption and possible volatilization to the atmosphere (ammonia, NH_3^+).

Hydraulic loading rates for irrigated acreage have been calculated (See Appendix N) to provide for leaching of dissolved solids through the root zone of crops. These calculations assume no reduction of dissolved solids by precipitation in the soil or by crop uptake. To the extent that these processes are likely to occur, but at an unquantifiable rate, the projections of TDS concentration estimated here are recognized to be high and represent a worst case condition. After a number of years of irrigation, the maximum allowable TDS concentrations in the soil-water of the root zone will be reached. An equilibrium concentration of TDS will be approached that will be determined by the leaching rate. The equilibrium concentration that would produce no more than a 10 percent reduction in average crop yield was used to estimate the appropriate leaching rate for sugar beets and corn (See Appendix N). At this equilibrium condition, the TDS load in the drainage water (5.7 inches/year for sugar beets and 12.3 inches/year for corn) will theoretically equal the TDS load in the applied irrigation water (24 inches/year for sugar beets and 26 inches/year for corn). Assuming an average TDS concentration in the irrigation water of 1500 mg/l, the resultant drainage water TDS concentrations would average 6300 mg/l for sugar beets and 2900 mg/l for corn. Drainage water volumes would range from 121 million gallons per year (Gering alone using sugar beets) to 642 million gallons per year (all three towns using corn). Assuming that drainage will occur over the 5-month irrigation period, the average daily input to local groundwater (or withdrawal from the soil by underdrains) would ~~range from 0.8 mgd to 4 mgd~~. Incorporation of this drainage water into groundwater would have a severe adverse impact on local groundwater supplies.

The areal extent of this high TDS load on groundwater would be determined by existing groundwater volumes and groundwater movement patterns and rates. Actual impacts of the dissolved solids concentrations increase on users of the groundwater resources would depend on the numbers, types (irrigation or domestic water supplies) and proximity of present or future groundwater wells. Surface waters which are recharged by affected groundwaters could also be impacted by the increase in dissolved solids. These possible impacts are discussed qualitatively below in regard to each of the proposed agricultural irrigation sites. The lack of site-specific geohydrologic information prevents detailed, quantitative estimation of groundwater impacts from agricultural irrigation. However, if an alternative incorporating either complete retention or agricultural irrigation is selected as the proposed action, extensive site analysis will be required for the proposed site.

The impacts of dissolved solids on local groundwater resources might be mitigated by interception of the drainage waters by underdrains installed beneath the root zones of irrigated acreage. This action would generate a problem of disposal for the intercepted drainage waters. Discharge of it to local streams would exacerbate existing water quality problems resulting from present irrigation return flows. Complete retention of the drainage waters would be feasible but would require additional land. Costs and designs for underdrainage and drainage water disposal have not been developed. To the extent that these costs are not included, the present worths and overall treatment costs per 1000 gallons treated for irrigation alternatives, as presented in Section III.C., could be even higher.

Seepage from the irrigation water storage ponds would also affect groundwater quality. Nebraska design standards for lagoons and storage ponds include a limitation of one-eighth inch per day of percolation water. Since the storage ponds will contain water except for a short period at

the end of the irrigation season, the yearly volume added to local groundwater would be approximately 1.25 million gallons per acre per year. Depending on the extent of regionalization, the seepage volume for various storage ponds would range from 117 to 267 million gallons per year. The quality of this seepage water should be more acceptable than the drainage water from irrigation acreage. Because of the permeability of the areas soils, these ponds would have to be adequately lined to achieve the design percolation rate. Some liners, such as Bentonite, would likely adsorb a substantial proportion of metals, phosphates and dissolved organic materials from the percolating water. Because there is no net evaporative water loss between the water in the pond and water which has percolated through the liner, quality of the percolating water should be better than and never worse than the water actually in the pond. All suspended solids and, as mentioned above, some proportion of the dissolved solids and organics should be removed. Bacterial and viral contamination of groundwater should be minimal or non-existent since chlorination will be provided prior to transport from the stabilization lagoons and since filtration and adsorption by the liner will, in the absence of physical damage effectively remove remaining organisms. The dissolved solids which do percolate would likely contain nitrates in approximately the same concentration as present in the pond contents, perhaps 10 to 30 mg/l.-N. Total dissolved solids in the percolating water are estimated to be 1000 to 1500 mg/l.

The conclusion expressed above that total dissolved solids would be the most significant water quality parameter for drainage waters from irrigation acreage is based on the assumption that at least five feet of undisturbed, finely textured soils are present above bedrock or the local water table. Review of available soils data reveals that this condition is not met in

all areas of the proposed irrigation sites. Soils data, proximity of sites to existing well water supplies and possible problems of induced seepage of drainage water to the ground surface are discussed below for each site.

North Site -- The proposed North Site is located at the edge of the bluff area separating the plateau from North Platte River valley. A finger of the plateau surrounded by bluffs on the west, south and east extends into the center of this site. Soils on top of the plateau are underlain by Arikaree Sandstone and, below that, Brule siltstone. The soils on the plateau were formed from the sandstone and may include wind deposited material. Sandstone and siltstone are exposed in places along the bluff and, in other areas of the bluff, are covered with thin soils weathered from the bedrock. Soils below the bluffs are formed from weathered materials that have been transported by gravity and water from the bluffs. Total depths of soil and parent material over the Brule siltstone are not known, but their combined depth is probably least at the foot of the bluffs and increases with distance from the bluff.

A distinct topographic, and probably hydrologic, divide intersects the site so that surface and groundwater on the west side of the site (Sections 23, 26 and half of 25) would flow into the Wind Springs Creeks drainage basin. (It should be noted that Wind Springs Creek is shown on U.S. Geologic Survey topographic maps as an ephemeral stream that terminates downstream without entering another body of surface water. Its periodic flow evidently recharge groundwaters in porous materials weathered from the bluffs. The depth and direction of flow of the receiving groundwater cannot be readily defined from available information.) Surface and ground-

water on the east side of the site would flow toward the Enterprise Canal. Locations of soils as interpreted from a 1919 soils map (Rockie, et al., 1919), Wind Springs Creeks and the drainage divide are illustrated in Figure III-9.

The Scottsbluff Facilities Plan proposal for using the North Site includes installing center pivot spray irrigation equipment on top of and below the plateau. Since the underlying sandstone is relatively porous and is underlain by Brule siltstone that is possibly impervious, percolating drainage water from the plateau acreage would likely emerge along the bluff at the contact between the formations. The thin soils at the foot of the bluffs could become excessively saline from this seepage.

Spray irrigation of acreage below the bluffs may not introduce drainage water into the permanent water table. At the edges of the valley, the permanent water table is probably well beneath the contact between the Brule siltstone and overlying colluvial debris. Although the Brule siltstone is known to be fractured in places, the location of fracture zones has not been plotted. Where not fractured, the Brule is relatively impervious and will likely support the drainage waters as a perched water table. Lateral movement of perched groundwater should be rapid since the colluvial debris is porous and permeable. Direction of movement would follow the slope of the contact with the Brule siltstone. Speculating that the surface topography approximates the bedrock topography, drainage water, if not intercepted by underdrains, would flow both west to the aquifer that receives flows from Wind Springs Creek and east toward Lake Alice and the Enterprise Canal. Whether this induced groundwater flow would surface at some point to recharge streams tributary to the North Platte, be intercepted by irrigation canals, or enter the permanent groundwater table cannot be predicted with available data.

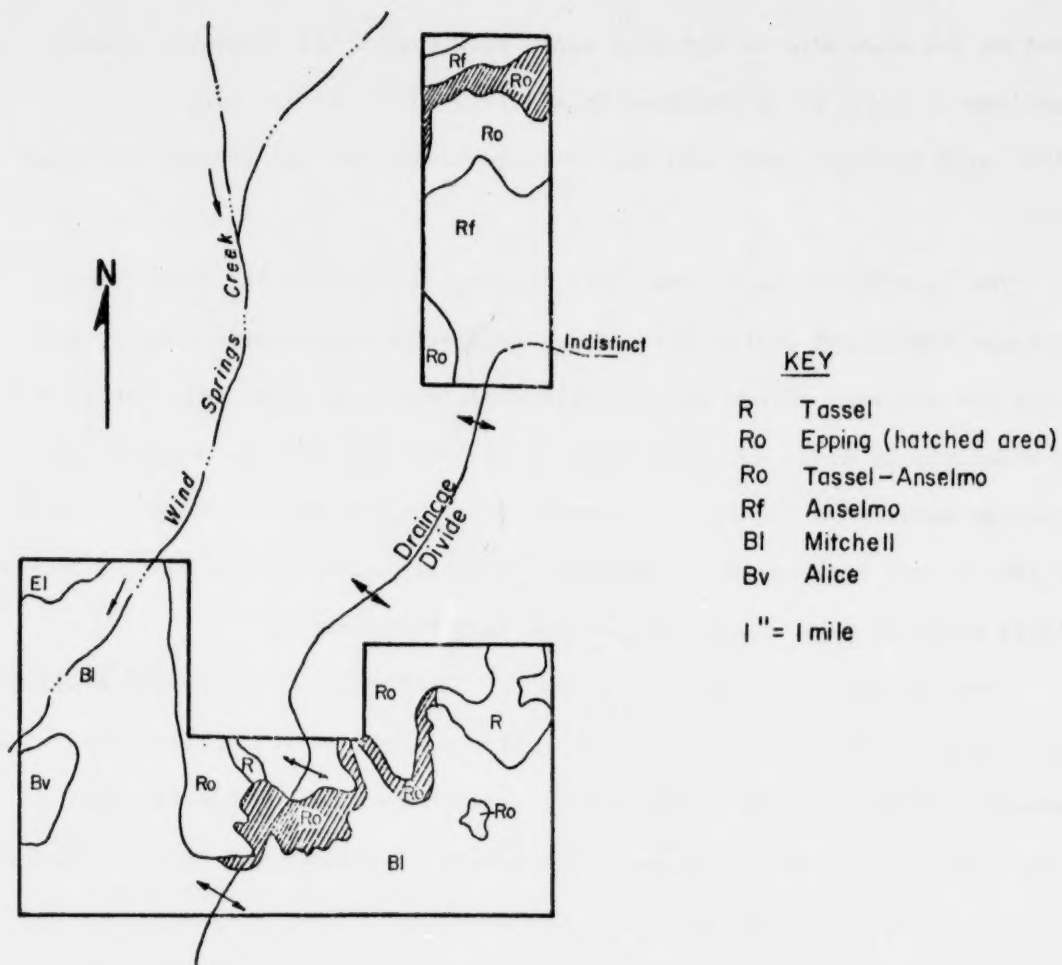


Figure III-9

Soils, Drainage Divides and Wind Springs Creek at the North Site. Wind Springs Creek is ephemeral and terminates just west of the site. Soil characteristics and use limitations are listed in Appendix D.

Between the North site and the Enterprise Canal, the only existing wells are for irrigation water supply and are few in number. As groundwater from the North site flows under the canal it will be diluted by seepage from the canal, from Lake Alice and from minor canals below it. The amount of dilution is not predictable. Periodic water quality monitoring of domestic supply wells south of the Enterprise Canal would be required.

Mitigating measures for groundwater quality deterioration would include interception of drainage water by a system of underdrains. Underdrains and means of drainage water disposal have not been designed and are not costed into the irrigation alternatives.

South Site -- The proposed south site is bounded on the north by the Mitchell and Gering Canal, on the south by a deep erosion gulley that drains a portion of the Wildcat Hills, and on the west by hills and knolls which are the eroded remains of a bluff formation analogous to Scotts Bluff. Surface drainage and groundwater flow from the site is to the east and northeast. Surface water flow is intercepted by the Mitchell and Gering Canal and by the erosion gulley. Minor topographic divides on the site are not distinct.

The entire site is underlain by Brule siltstone. Soils are formed directly from the Brule and from materials eroded and transported from Brule siltstone. Soil types mapped for the site are generally deep except at the top of the several hillocks where soil types (Keota and Epping series) can be as thin as 20 inches. Locations of soils and expected drainage patterns are illustrated in Figure III-10.

As with the North site, depth of the Brule siltstone relative to the groundwater table is not known. Drainage water could, therefore, create a perched water table. Because of the proximity of an erosion galley to the

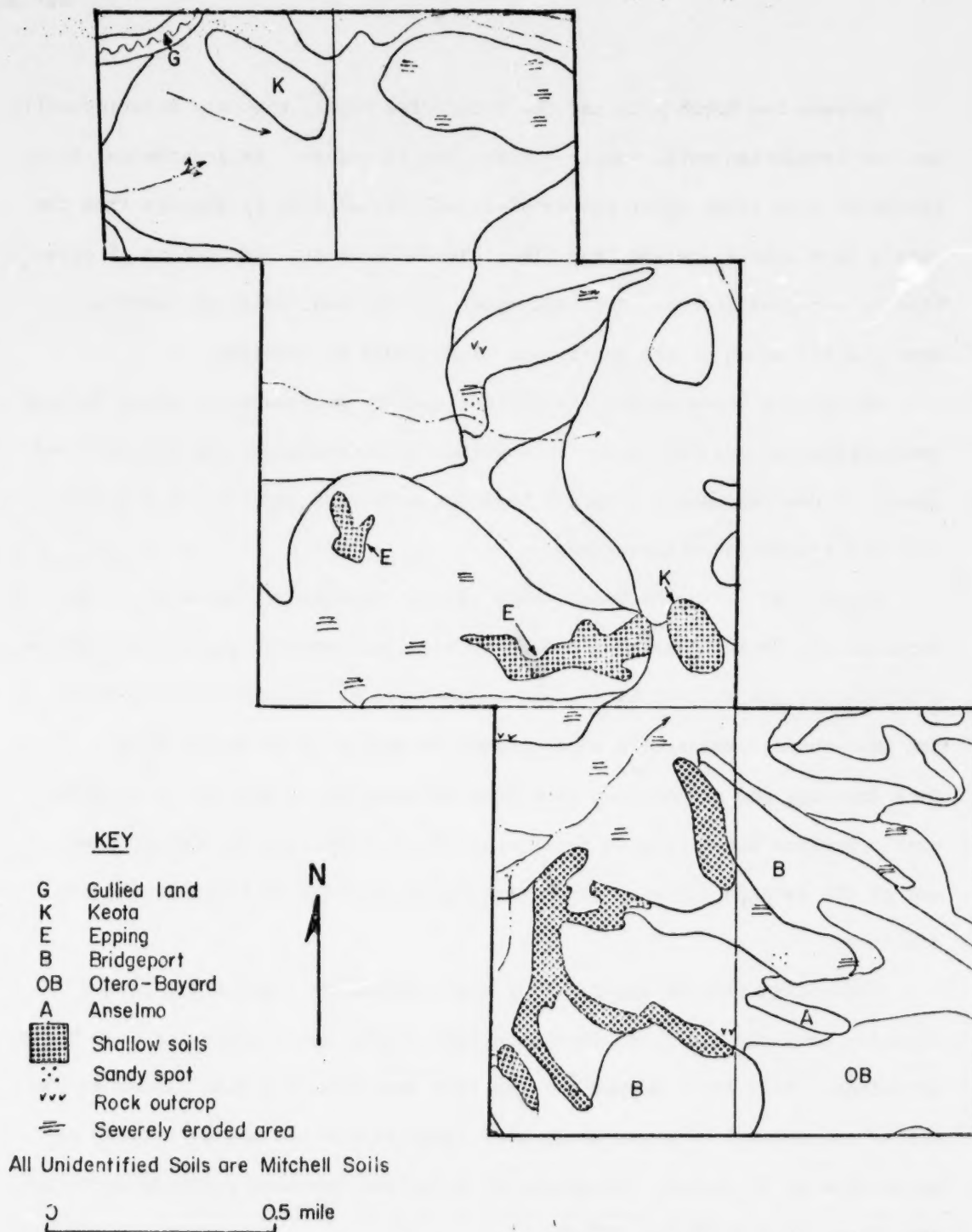


Figure III-10

Soils of the South Site. Soil characteristic and use limitations are listed in Appendix D.

south of the site, lateral movement of drainage water could result in sub-surface recharge of the fulley. Groundwater entering a perched or permanent groundwater table would likely flow east and then northeast under the Mitchell and Gering Canal. The Canal undoubtedly loses water through percolation which would tend to dilute the irrigation drainage water; but, in comparison to the Interstate Canal below the North Site, the Mitchell and Gering canal is nearly at its terminus here, is small, and would lose a much smaller volume of water to provide dilution of the drainage water. Also in comparison to the North site, the South site and surrounding acreage is cultivated and, therefore, includes widely scattered farm dwelling. These farm dwelling rely upon the groundwater for domestic water supply. The threat of groundwater contamination at these wells cannot be accurately predicted because of the lack of local hydrogeologic data. The greatest threats are posed by total dissolved solids from irrigation drainage waters (2900 mg/l to 6300 mg/l maximum depending on leaching rate) and nitrates from storage pond percolation (10 mg/l to 30 mg/l).

The problem of raised water tables and the resulting "seeps" induced by irrigation water losses to the groundwater is a matter of concern near the South site. The problem is highlighted by the presence of Cochran Lake, approximately 2 miles north of the South site. The source of inflow to this fishing lake has not been conclusively determined. But judging from the small acreage that is directly tributary to it, and from the small volume of irrigation return flow entering it during a recent site visit, its source of inflow must either be from intentional filling by canal water or recharge by groundwater. Based upon examination of U.S.G.S. topographic maps and aerial photos in Soil Survey for Scotts Bluff County, Nebraska (Yost et al., 1968), the probability of storage pond percolation water and irrigation drainage from the South site contributing to groundwater recharge of Lake Cochran is

remote.

Formation of new seepage areas by accelerated groundwater recharge is a more likely impact of agricultural irrigation. The 1937 groundwater elevations in wells located adjacent to and down hill from the Mitchell and Gering Canal were only 5 to 20 feet below the surface compared to 16 feet in a well next to Lake Cochran (Wenzel et al., 1946). Possible areas for development of new seeps would likely be in relatively level areas below the Canal and north to northeast of the South site.

Valley Irrigation Area, North -- Specific irrigation sites have not been identified for either of the valley irrigation areas. (See Figure I-3). Soils in the North Valley Irrigation area are formed from terrace deposits and are permeable and well-drained. The topography is relatively level and an extensive canal and ditch system already provides irrigation water to this prime agricultural land. The groundwater table slopes uniformly toward the North Platte and is no doubt artificially elevated by canal seepage and irrigation drainage. Mixed sand and gravel deposits often underly these soils at depths of 40 inches to six feet.

Associated with the intense agriculture throughout this area are scattered residences utilizing the groundwater for domestic water supplies. An agricultural irrigation site in this area would have the greatest potential of the four sites considered for adversely impacting existing wells because of the high permeability of underlying sand and gravel deposits and the relatively high density of domestic wells.

The sand and gravel deposits underlying local soils could also make it difficult and expensive to construct storage ponds so that they will not percolate excessively. This problem might, however, be avoided by building storage ponds on the low terraces considered below as a site for complete

retention lagoons in the valley.

The North Valley Irrigation area is situated on the third terrace above the North Platte. This terrace is sharply differentiated from the more recently deposited first and second terraces by an escarpment paralleling the river. Drainage and percolating waters could emerge in springs that exist at the base of this escarpment to discharge to Winter's Creek Canal.

Valley Irrigation Area, South -- Soils in the South Valley Irrigation Area are formed primarily from materials eroded and transported from Brule siltstone. In contrast to the North Valley Irrigation Area, irrigable land exists adjacent to the flood plain of the North Platte so that irrigation acreage and storage ponds could be located such that no domestic water supply wells would lie between irrigation facilities and the sand and gravel aquifer beneath the river. Similarly, groundwater from irrigation facilities bordering the Gering Drain would enter the drain and be carried away with little impact on domestic supplies. Associated with the present agricultural use of this area, there are existing residences. Depending on the site chosen and other unresolved variables, wells serving individual residences could be impacted by nitrates or TDS from irrigation facilities.

Valley Complete Retention Site -- This site is in deep, strongly alkaline soils (Minatare-Janise) on bottom lands north of the North Platte river. The groundwater table is within a few feet of the surface and soil depth to mixed sand and gravel deposits is typically about 40 inches. Surface drainage is slow or non-existent. Lateral groundwater movement is parallel to flow in the North Platte and is very slow, about one foot per day.

Soils above the mixed sand and gravel are alkaline and are clayey. They would probably make adequate pond lining material, especially if amended with swelling clay material such as Bentonite or with chemicals such as sodium tripolyphosphate. Percolation through a pond liner at this site would be

regulated by the liner's permeability and the hydrostatic head of the pond's contents above groundwater. Because of the high groundwater table, percolations rates would be slow. Infiltration of groundwater into the ponds could be more of a problem depending on the depth of excavation necessary to provide adequate pond depth.

Few residences or domestic water supply wells are located near this site. Considering this, expected low percolation rate from the lagoon and slow rate of movement of existing groundwater, groundwater quality impacts of a complete retention pond of this site is expected to be minimal. Detailed soil analysis and geohydrologic analysis would be necessary to support this preliminary analysis. A more severe problem would be groundwater mounding around the lagoon even with very slow percolation rates. This could be mitigated by installing toe drains around the perimeter of the pond dikes and returning seepage to the ponds.

6. Aquatic Biology Impacts

Impacts on aquatic biology are organized and discussed by component.

a. Flow and Waste Reduction

The industrial pretreatment options of screening and DAF or maximum pretreatment will both have a beneficial effect on aquatic biology by reducing oil and grease and nutrients (nitrogen and phosphorus) that are currently being discharged into the North Platte or that would be discharged by stream discharge alternatives for Gering and Scottsbluff.

b. Collection System

None of the collection system options under consideration would be expected to have significant impacts on aquatic biology.

c. Treatment Plant Siting

The two options of filling existing lagoons in Scottsbluff or abandoning and filling existing lagoons in Gering would both have short term, temporary negative impacts. The impact would be in the form of increased turbidity and siltation in the North Platte during the construction period. Silt deposits are expected to be washed away by the natural scouring action of the river after construction completion. The amount of material that could be eroded from the disturbed soils would be negligible compared to the sediment load that the river presently carries.

d. Wastewater Treatment Processes

Several treatment process options would have short-term, negative construction impacts. These include (1) construction of new aerated lagoons in Scottsbluff and Gering, (2) rerouting raw sewage distribution lines for Scottsbluff and Gering lagoons, (3) construction of a new stabilization lagoon in Gering, (4) installation of activated bio-filter with nitrification and (5) effluent DAF before stream discharge for Scottsbluff, Gering, and

regional treatment. The impact of facilities construction on aquatic biota would be very minor since the total sediment load of the river would be changed by a negligible amount.

If no industrial pretreatment is the option chosen for the flow and waste reduction system component, then a preliminary DAF system would be installed at the Scottsbluff lagoon and would have a beneficial aquatic biological impact of reducing oils and grease discharged into the North Platte. Similarly, effluent DAF before stream discharge of lagoon effluents would have a beneficial impact of reducing suspended solids, organic colloids, BOD and oil and grease. However, TDS would increase for this option as a result of chemical treatment additions. Under worst case conditions of 7-day, 2-year low flow and an assumed incremental increase in TDS of 100 mg/l due to alum additions, the change in TDS concentration at design flow would be only 5 mg/l, a negligible amount compared to the current average concentrations of 614 mg/l.

e. Effluent Disposal

Three basic options for effluent disposal are under consideration (1) complete retention (2) agricultural irrigation and (3) stream discharge. Complete retention would be the most beneficial from an aquatic biological standpoint since no effluent would be discharged into the streams.

Agricultural irrigation also has a minimal impact on aquatic biology since the only potential problem of this effluent disposal option is an increase in TDS and nutrients in surface waters due to agricultural run-off. Spray or ridge and furrow irrigation at the Valley irrigation areas would not increase sediment in runoff since these areas are already cultivated and irrigated. Spray irrigation at the North site would increase sediment in runoff as a result of the conversion from range to cultivated lands.

Drainage patterns in the area are not well defined and it seems likely that surface runoff from the North site will reach neither irrigation canals nor streams. Runoff from any of the sites could be avoided by proper installation of runoff collection berms and holding basins. If underdrainage from any of the sites is collected to protect groundwater, it should not be discharged to any of the small streams in the study area because of adverse impacts of high TDS concentrations on aquatic biota.

Stream discharge is the disposal option with the most potential for affecting aquatic life. The major by-products of the secondary sewage treatment process of concern for the North Platte are TDS, chlorine residuals and ammonia nitrogen.

Total Dissolved Solids (TDS) -- TDS or conductivity is an indication of the amount of dissolved salt ions in water. TDS is usually measured in parts per million while conductivity is measured in umhos. TDS are important to fish for their osmoregulation processes. Too little or too much TDS can limit the presence and abundance of fish species occurring in a specific aquatic habitat. Ellis (1937) in Tsai (1973) reports that 1100 umhos is the upper conductivity limit for a healthy fish fauna in Pennsylvania, Virginia and Maryland waters.

As discussed in the water quality section Nebraska state TDS standards are currently based on ambient river levels plus a 10% margin. The standards have been reviewed and approved by the Nebraska State Department of Fish and Game.

Only if all three municipalities dispose of treated wastewater in the design year by stream discharge into the North Platte will total dissolved solid loads be increased above present levels. If either Scottsbluff or Gering use complete retention or land disposal, the future TDS load will be reduced below present levels.

Chlorine Residuals -- Tsai (1968 and 1970) and others have demonstrated that fish populations can be seriously reduced below discharges of chlorinated sewage effluent. As pointed out by Tsai (1973), trout species are particularly sensitive to chlorine.

In order to ensure the protection of the valuable recreational trout fishery that exists in the North Platte and Lake C. W. McConaughy, the Nebraska Department of Environmental Control has informally stated that the requirement for effluent disinfection could be waived after appropriate notification and public hearings in order to protect fish in the North Platte. Alternative means of achieving disinfection have not been evaluated.

Ammonia Nitrogen -- Ammonia nitrogen is a by-product of sewage treatment which can be toxic to aquatic organisms. The toxic component of ammonia solutions is unionized ammonia. The amount of unionized ammonia in aquatic systems is directly related to pH (McKee and Wolf, 1963) and temperature (Ball, 1967). The pH levels in the North Platte are alkaline, generally ranging from 8.2-8.6. The amount of ammonia occurring in the form of unionized ammonia at this pH and a temperature of 20°C would be about 10%.

Because of high dilution ratios in the North Platte River, ammonia is of concern only in the mixing zone below outfalls. Concentrations of unionized ammonia could range from 0.14 mg/l to 2 mg/l within the mixing zone at low flow conditions. At these levels trout would likely avoid the wastewater plumes below outfalls and may be prevented from migrating up through the plumes to spawning streams. The likelihood of low flow conditions (late summer) trout migration (Spring and fall), and high effluent ammonia concentrations (early spring) co-occurring to create this impact are very small, however.

If the stream discharge option is chosen, effluent quality will be

considerably improved over the present stream discharge system. The improvements will include reduction of oil and grease and phosphorus to low levels. BOD and suspended solids, which previously exceeded state standards, will be reduced to levels to meet state effluent limitation guidelines.

f. Sludge Handling and Disposal

The only potentially detrimental aquatic biological impact of this component is leaching of wastes from the municipal landfills. The water table at the Scottsbluff landfill is within a foot of the surface. This poses a potential for groundwater contamination that must be resolved before any alternative requiring disposal here is approved. This will require a complete review of the present location, alternative sites and present operation. Based on present knowledge, an improvement in operational procedures is needed to permit disposal of municipal sludges and grit. The Gering landfill is located well above the water table and a considerable distance from the river thus making the chances of leachate from this site reaching surface waters more unlikely. However, the site is situated directly in the local drainage patterns. A careful review of this situation would also be needed before EPA would approve any alternative requiring disposal here.

7. Impact on Terrestrial Biota

Most land on which proposed sewage treatment plants and effluent disposal areas would be located supports terrestrial life. Vegetative, avian, mammalian, reptilian, and amphibious species exist in these areas. Their habitat is directly threatened by the prospect of additional land requirements for sewage treatment facilities.

Although information necessary for a detailed description of changes in biological productivity was not developed in the Facilities Plans, a general discussion of these changes for each alternative is sufficient to permit comparisons to be made.

a. Complete Retention-North Site

The land use of north site presently is rangeland. The topography is hilly with areas of steep bluffs. The area is vegetated with short grasses such as sideoats grama, prairie dropseed, needlegrass, little bluestem, and junegrass. Because there are no permanent water resources, little riparian vegetation and water based wildlife occurs in this area. However, because the land is not under intensive agriculture, it probably provides habitat for a variety of upland mammals and reptiles. Of all sites under consideration in this report, the North site has the highest probability of being habitat for mammals considered by the State of Nebraska as rare such as the black-footed ferret.

Should this site be utilized for complete retention, several major changes would occur. The most significant permanent impact would be the elimination of 296 to 1484 acres of grassland, depending on the alternative utilized, and

establishment of an aquatic habitat. Nearly all mammalian and reptilian residents would be killed or displaced. Further, the retention pond would be fenced, which could potentially effect the movement patterns of animals. "A wild population normally exists at the highest possible level in view of the hardships imposed on it. Thus to increase the level of hardships has the inevitable effect of reducing the population level." (Nebraska Game and Parks Commission, 1972). The retention pond would provide a resting and feeding area for certain species of waterfowl. Long term effects on waterfowl resulting from intimate contact with sewage is not known. However, waterfowl have used the existing area lagoons as long as they have been in existence.

The pipeline route to the North site will follow roadways and will not disturb windbreaks (trees) planted alongside the roads. Where vegetation is disturbed by pipeline construction, appropriate measures to minimize soil erosion while the area revegetates will be taken. This applies to all alternatives utilizing pipelines.

A potential adverse impact that may result from complete retention alternatives is the proliferation of mosquito and other insect breeding. Many species require permanent standing water in which to breed. The ponds would provide such a habitat requirement and enhance reproductive success. Specifically, the problem of mosquitoes in the irrigated areas of the North Platte River Valley has been and continues to be of serious concern. Therefore, measures to prevent and/or reduce the breeding of mosquitoes in the complete retention pond should be investigated.

b. Complete Retention - South Site

This site is completely utilized for agriculture. Recent field inspection showed this area to be strip-cropped in wheat. No permanent streams exist on site. "Row crops, though of little importance to upland game during the spring

months, may provide an important source of food and cover during other periods of the year." (Nebraska Game and Parks Commission, 1972).

The significant permanent impact of complete retention at this site would be to create an aquatic habitat ranging in size from 296 to 1484 acres and to provide rest areas for waterfowl. The corresponding loss of the land surface will result in an increased demand for food and cover on adjacent agricultural lands, and an ultimate decrease in wildlife population levels. The pond and fenced area will, as with the North site, prevent colonization of the site by larger species of mammals and amphibians. The fence and pond also will alter movement patterns of certain species of animals.

c. Complete Retention - Valley Site

Although the Valley site has not yet been specifically identified, it has been generally placed in the N. Platte River valley southeast of Scottsbluff. The area's topography is flat, sloping slightly toward the river. This area, owing to the alkaline nature of the soils, presently supports saltgrass meadows and is used chiefly for pastures. Owing to the agricultural nature of this area, the quality of wildlife habitat is judged to be low as well as populations of wildlife species.

The retention pond will create permanent aquatic habitat suitable for waterfowl to congregate, as is the case with the other complete retention alternative locations. The acreage also remains the same as the other alternatives.

d. Agricultural Irrigation - North Site

The terrestrial features of this site, described under Complete Retention - North Site, would be altered permanently under this alternative. Using center pivot spray irrigation, large circular areas would be planted for crops and harvested. On the remaining areas, the increased moisture supply would provide

the means for other species of plant associated with wet soils to invade and occupy the areas now inhabited by short grass vegetation. These 'fringe' areas probably would be mowed occasionally to prevent the growth of trees, shrubs and tall grasses. Any wildlife inhabiting the site would be killed or displaced, and prevented from reinhabiting the area by fencing. Fencing also will alter the movement patterns of animals in the area.

A holding pond ranging in size from 94 to 214 acres also will be constructed. This will create permanent aquatic habitat for waterfowl, and possibly other water-based wildlife (e.g., muskrat, otter, etc.), but fencing will prevent the utilization of the storage pond by most other forms of wildlife.

Mosquito breeding also is associated with irrigation (US HEW 1953, 1977). Such breeding places have been identified as roadside ditches, irrigation field laterals, borrow pits, surface pools in fields, farm ponds, and seeps. Upland areas, such as the North site, are considered to produce relatively low levels of mosquitoes as compared to river valley areas. The introduction of irrigation to yet another site would provide additional breeding areas. Prevention of standing water in the fields and in natural depressions can reduce the potential for mosquito breeding. All mosquito prevention measures for the holding pond and other areas will be investigated.

Scottsbluff irrigation alternatives (AIN, AIS, AIV) will require an additional permanent 10 acres at the treatment plant site for an aerated lagoon, most probably at the northwestern corner of the existing lagoons. Land between the municipal treatment plant and the Great Western Sugar Co. lagoons would be utilized. This land is in a highly disturbed state and supports no distinct biological communities.

Gering alternatives AIN 1, AIS 1, and AIV 1, will require an additional 120 acres adjacent to the treatment plant. The City of Gering presently owns an 80 acre plot to the south of the plant which is fallow land. The remaining 40 acres probably would be agricultural land adjacent to the 80 acre plot. The land would be permanently preempted for the stabilization lagoon. Waterfowl could be expected to use the lagoon for resting and feeding.

Gering alternatives AIN 2, AIS 2, and AIV 2 would require 5 permanent acres in addition to the existing site for an aerated lagoon. The city-owned fallow land to the south should be used with no significant impact to the terrestrial biota of the area.

e. Agricultural Irrigation - South Site

Because this site already is developed for agricultural use, as described earlier, no significant impact on terrestrial biota is expected. Mosquito breeding prevention would probably be necessary because a permanent holding pond of 94 to 214 acres would be constructed. Also, surface ponding in irrigated areas should be prevented as should any water buildup in lower levels of the site. This will help prevent mosquito breeding in these areas.

The site would be fenced, preventing access by animals. As described earlier, this will result in increased pressure on adjacent agricultural land for food and cover by animals, and an eventual change in population levels. The holding pond will provide area for waterfowl to congregate.

f. Agricultural Irrigation - Valley Site

It is assumed that the valley site already is irrigated. The only change would be a different source of irrigation water. The ridge and furrow method of irrigation would be employed which would consist of a series of mounds and depressions formed to transport the irrigation water. No significant impacts on

terrestrial biota are expected. As with all other irrigation alternatives, mosquito breeding prevention should be investigated.

g. Stream Discharge Alternatives

Scottsbluff alternative S.D. 1 includes filling the existing lagoons. No additional land is to be taken. The significant impact of this action is to eliminate resting places for waterfowl.

Scottsbluff alternatives S.D. 2 and S.D. 3 require 12 additional acres for an aerated lagoon. As with the irrigation alternatives, the most probable area for this lagoon would be to the northwest of the existing lagoons. Preemption of this land is discussed under agricultural irrigation alternatives for the North site.

Whereas alternative S.D. 4 for Scottsbluff requires no modifications to the adjacent land areas, no impact to terrestrial biota will occur.

The Gering alternative S.D. 1, as with the agricultural irrigation alternatives AIN 1, AIS 1, and AIV 1, will require an additional 120 permanent acres for a stabilization lagoon. Briefly summarized, the principal impacts of this alternative are the conversion of 120 acres of terrestrial habitat to an aquatic environment. All terrestrial biota will be destroyed or displaced as a result of lagoon construction. Positive effects will include improved habitat for waterfowl and water-based wildlife.

Gering alternative S.D. 2 requires only a 5 acre aerated lagoon. City-owned fallow land would be utilized. No significant impacts to wildlife or vegetation are anticipated.

There are no significant terrestrial biota impacts associated with the Terrytown alternatives as they do not require additional land.

Regional alternatives for complete retention and agricultural irrigation are included in the discussions above. Regional alternatives utilizing stream

discharge would employ space conserving treatment facilities on either the Scottsbluff or Gering sites, and would not require additional land. With the exception of a force main connecting the Scottsbluff lagoon to the South site all proposed interconnecting pipelines that cross the N. Platte River would be built along planned or existing roads and bridges in order not to impact wetland areas. The river crossing to the South site would temporarily disturb the wetland vegetation along a 50 foot wide temporary construction easement on the banks of the river and on the river islands. Revegetation by grasses would be accelerated by ground preparation and seeding. Revegetation by cottonwoods or native brush species would follow unless prevented by maintenance cutting.

Table III-17 summarizes the acreage of various habitat types which would be altered or used by terrestrial biota in each of the alternatives. Pipeline routes are not included in this table because any disruption associated with them generally is limited to the construction period and a short period thereafter. Appropriate ground preparation and reseeding would accelerate vegetative recovery in disturbed areas.

h. Rare and Endangered Species

As described in the Environmental Setting section of this report, certain species of mammals and birds considered to be rare and endangered by the State of Nebraska probably inhabit Scottsbluff and Sioux Counties. Endangered species include the Blackfooted ferret, Swift fox, American peregrine falcon, and the Whooping crane. Rare species include Richardsons ground squirrel, Greater sandhill crane, Trumpeter swan, Bald eagle, and the Burrowing owl.

The Blackfooted ferret is an inhabitant of prairiedog towns. Of the sites under consideration in this report, only the North irrigation/or retention

Table III-17

Acreages of Terrestrial Habitat Altered by System and Regional Alternatives

<u>Alternative</u>	<u>Intensive Agricultural</u>	<u>Rangeland</u>	<u>Fallow</u>	<u>Other^b</u>
<u>Scottsbluff</u>				
CRN ^a		340-787		
CRS ^a	340-787			
CRV ^a	340-787			
AIN		1391		10
AIS	1391			10
AIV	1391			10
SD1				
SD2				12
SD3				12
SD4				
<u>Gering</u>				
CRN ^a		296-626		
CRS ^a	296-626			
CRV ^a	296-626			
AIN 1	40	1067	80	
AIN 1	1107		80	
AIN 1	1107		80	
SD1	40		80	
SD2			5	
AIN 2		1067	5	
AIS 2	1067		5	
AIV	1067		5	
<u>Terrytown</u>				
T1				
T2				
T3				
<u>Regional^c</u>				
AIN		2550		
AIS	2550			
AIV	2550			
Complete Regionalization				
Joint Clarification				
CRN		673-1484		
CRS	673-1484			
CRV	673-1484			

a Variation depends on percolation rates through the lagoon lines

b Highly disrupted land adjacent to the Scottsbluff Treatment Plant

c Includes Terrytown's wastes

site is sufficiently undisturbed to have prairie dog towns. Likewise, the swift fox is an inhabitant of grasslands which are not disturbed by intensive agriculture. Also, the peregrine falcon generally is an upland species. The Whooping crane is known to migrate through areas along the Platte River.

The Richardson ground squirrel, Bald eagle, and Burrowing owl are all known to inhabit the panhandle section of Nebraska. The Greater sandhill crane and Trumpeter swan occur in the vicinity of the N. Platte and reservoirs of the area as migratory species only.

Presently, the U.S. Fish and Wildlife Service is reviewing the potential impacts of alternatives considered here. Measures to minimize impacts to rare and endangered species will be recommended by the Fish and Wildlife Service and followed in the implementation of the selected alternatives.

8. Agricultural Land Use Impacts

With the exception of a new 120 acre stabilization lagoon for upgrading the Gering lagoon system, 80 acres of which are already owned by the City, agricultural land use impacts would result only from construction and operation of complete retention and agricultural irrigation facilities. These impacts fall into three categories:

- Elimination of productive agricultural acreage by construction of storage ponds and complete retention lagoons
- Conversion of range land (North site) and dryfarmed land (South site) to use in growing row crops such as corn or sugar beets.
- Potential for altering productivity or irrigated soils

a. Elimination of Productive Agricultural Acreage

Construction of complete retention ponds or storage ponds as part of agricultural irrigation facilities would result in long-term and possibly irreversible elimination of productive agricultural acreage. Depending on the extent of regionalization adopted, the land so impacted would vary from 343 to 1781 acres for complete retention and from 124 to 244 acres for irrigation storage ponds including dikes and buffer zones. Equivalent annual productivity decreases would be:

	<u>Agricultural Irrigation Storage Ponds</u> 124 to 244 acres	<u>Complete Retention Ponds</u> 343 to 1781 acres
North Site	Summer grazing for 12 to 24 yearling cattle or 8 to 16 cow/calf pairs	Summer grazing for 33 to 175 yearling cattle or 22 to 177 cow/calf pairs
South Site	1240 to 2440 bushels of wheat	3430 to 17810 bushels of wheat
Valley Site	2700 to 5400 tons sugar beets or 13,600 to 26,800 bushels of corn	7500 to 39,000 tons of sugar beets or 38,000 to 196,000 bushels of corn

In terms of dollars, loss due to changes in agricultural productivity is the difference between crop worth and the cost of growing the crop except for the North site where productivity can only be measured by its seasonal grazing value. Monetary losses are incorporated into the cost effective analysis of land disposal and complete retention alternative as described in Appendix P.

b. Conversion to Growing Row Crops

Conversion of range land at the North site and wheat acreage at the South site to row crop agriculture is a beneficial, reversible impact of agricultural irrigation alternatives. In western Nebraska irrigable acreage is limited by topography, irrigation canal location and groundwater availability. On a regional basis there is considerably more range and dryfarmed land than irrigated land because of these limitations. Increasing the amount of irrigated land by pumping treated effluent to the North or South sites overcomes these limitations for a proportionately small amount of land. Use of the Valley Irrigation areas for agricultural irrigation alternatives does not alter the amount of irrigable land. For the purposes of cost-effective analysis increases in productivity at the North and South sites are measured as the difference between present crop production and irrigated crop production. Therefore, "net crop benefit" is the net profit (after costs) of this increment in crop resulting from irrigation. Values for present and irrigated net crop benefits at the North, South and Valley Irrigation sites are listed in Appendix P. The overall increases are \$288/acre-year for the North site, \$277/acre-year for the South site and \$32/acre-year for Valley sites. The \$32/acre-year increase for the Valley site results from a \$24/acre credit for nitrogen in the treated effluent and avoidance of the \$8/acre irrigation water fee.

c. Potential for Altering Productivity of Irrigated Soils

Public concern about the effects of irrigating land with treated wastewater was expressed several times at public hearings on the Scottsbluff Facilities Plan. Concerns about the Sodium Adsorption Ratio (SAR), Sodium Bicarbonate Equivalent and chloride concentration of the irrigation water were addressed in environmental assessments for the North and South sites. Review and analysis of available data supports the conclusions that these parameters are not critical to the long-term productivity of soils at any of the irrigation sites and areas investigated here. Of particular interest in this regard is the abundance of dispersed calcium minerals in soils weathered from Brule siltstone. Calcium minerals should effectively counteract the clay flocculating tendency of the moderate SAR/high TDS concentration wastewaters.

Parameters having known potential for altering agricultural productivity are Total Dissolved Solids (TDS) concentration and boron concentration. The relationships between these parameters and productivity are discussed in Appendixes N and O. In summary, the adverse effects of high TDS concentrations can be mitigated up to a point by adjusting the leaching rate of applied irrigation waters. Certain crops such as reed canary grass and alfalfa are precluded from use because of the low tolerance to TDS and unreasonably high leaching rates necessary to maintain reasonably low soil-water TDS concentration.

Boron concentrations in the study area's raw wastewaters are relatively high and are quite variable as reported in the Scottsbluff and draft Gering Facilities Plans. If the average boron concentrations reported were constant, no short-term adverse impacts on sugar beets (tolerant) or corn (semi-tolerant) are to be expected. However, two critical points in regard to boron need to be made:

- Boron concentrations in Scottsbluff's wastewater varied greatly over the interval of several months. Peak concentrations were above reported acceptable limits for either sugar beets or corn. Therefore, prior to implementing any agricultural irrigation alternative, vigorous monitoring of boron concentrations and a search for the source(s) of boron in the collection system should be carried out. Eliminating or reducing the input of boron may avoid plant toxicity impacts.
- Available literature on boron toxicity does not thoroughly describe the possibility of boron buildup in soils over the long term. One source (USDA, 1954) explains that boron may not leach through a soil profile as rapidly as other dissolved ions. A leaching rate capable of limiting TDS to acceptable concentrations in soil-water may allow boron to accumulate gradually over a long period of application. Periodic flooding or application of irrigation water of very high rates may be necessary to control boron concentrations.

Three other wastewater constituents are of minor or unpredictable concern to agricultural productivity: zinc, phenols and mineral oils. Lockwood, Inc.'s wastewater was sampled on October 21, 1977, by the Nebraska Department of Environmental Control and found to contain 30.9 mg/l of zinc. The full sampling report is in Appendix G. Short-term monitoring of Gering's wastewater reported in the draft Gering Facilities Plan indicates that any zinc contributed by Lockwood was sufficiently diluted by other wastes to be undetectable by the analytical methodology used. Increases in zinc concentrations in the North Platte between the state line and McGrew indicates that there may be some source of zinc in the Primary Study Area.

Phenols and mineral oils at low concentrations and low loads are discharged to the Scottsbluff lagoon system by CRA, Inc. Mineral oils also are

periodically or rarely spilled into collection systems by machine shops or garages as evidenced by a slug load of oil discharged to the Terrytown system recently. Routine monitoring of these and any other potentially harmful substance discharged by new industrial or commercial concerns should be an integral part of any agricultural irrigation system.

Lastly, high nitrogen content of irrigation water applied to sugar beets toward the end of the growing season may result in reduced sugar content of the harvested beets. This reduces the value of the crop. Minor increases in the irrigated acreage and supplementation of irrigation waters with canal or river water can avoid this impact if it is cost-effective.

9. Non-Agricultural Land Use

Impacts to land which is not devoted to agricultural purposes include the following types:

- Conversion of industrial land for pretreatment facilities
- Conversion of municipally owned land currently used for sewerage treatment facilities to non-specified municipal uses
- Conversion of municipally owned land currently used for one type of sewerage treatment facility to another type of sewerage treatment facility
- Placement of sewage transport lines and maintaining temporary and permanent easements and rights of ways
- Commitment of additional lands for sewerage facilities additions, effluent disposal areas, and sludge disposal (landfill) areas

These categories of impacts are applicable to various functional components of the system and regional alternatives. Several options of each component have these types of impacts as discussed below.

a. Industrial Pretreatment

The options for industrial pretreatment include 1) no pretreatment, 2) DAF and screening, and 3) maximum pretreatment. Impacts resulting from no pretreatment on non-agricultural land use are additional land requirements at the Scottsbluff Treatment Plant for screening and DAF units.

. This is part of the Scottsbluff

Alternative SD2.

On-site pretreatment by screening and DAF units would require small land commitments by major contributing industries on an individual basis for the construction of these facilities. Alternatively, in Gering the land commitment could be met adjacent to the existing lagoon system since the major industrial wastes are sewered separately from domestic wastes.

Maximum pretreatment requirements for Flanery Foods, Inc. would call for sufficient land on-site for an anaerobic lagoon, in addition to screening and DAF units. Anaerobic-aerobic lagoons are already provided in Gering. It is assumed in this report that the lagoons will be retained for future industrial use regardless of other factors.

b. Collection Systems

All new sewage transport lines that would be constructed will require temporary construction and permanent maintenance easements. Generally, the construction easement will have a total width of 50 feet of which 20 feet will be the permanent easement. The length and total acreage for the easements are shown in Table III-18 for options requiring new raw sewage interceptors. It should be pointed out that whenever possible, pipelines are located alongside existing roads to minimize environmental damage and commitment of private land for public use.

Short-term land use impacts of installing raw sewage interceptors will be disruption of the land use over the width and length of the easement as well as disruption of traffic movement patterns in the construction areas.

Long-term impacts would be in the form of limitations on land use in the permanent easements. Building restrictions will be the major limitation.

Table III-18. Sewer Line Easement Acreage

Options and Applicable Alternatives	Pipeline Length and Type	Total Acreage		Comments
		Temporary	Permanent	
Reroute Airport Sewer (Scottsbluff SD 1,2,3,4, complete Regionalization)	5500' Gravity	6.3	2.5	Along road. Overland and tunnel under Route 26.
	1200' Force Main	1.3	.5	
Gering to Scottsbluff (Complete Regionalization)	5000' Force Main	5.7	2.3	Over N. Platte via new 21st Ave. Bridge
Terrytown to Scottsbluff (Complete Regionalization, Terrytown Alts.)	1000' Force Main	1.1	.4	Over N. Platte via Rt 71 bridge
Terrytown to Gering (Complete Regionalization, Terrytown Alts.)	8000' Force Main	9.2	3.6	Along road (5500') Overland (2500')

c. Plant Siting

The options for treatment plant siting include elimination of existing facilities, modifications to existing facilities, and construction of new facilities on present and new sites.

Wastewater treatment process options which utilize only the existing treatment facilities will create no impact on non-agricultural land. The system alternatives which include the use of the existing treatment facilities without requiring additional non-agricultural land are: Scottsbluff CRN, CRS, CRV, SD4 and Terrytown T2, T3.

Several alternatives require varying amounts of land adjacent to the existing facilities for additional equipment or lagoons. Table III-19 lists those systems and explains the new land use requirement. For purposes of this examination, it is assumed that most of the 120 acres required for the Gering system alternatives are non-agricultural in nature, and that the Scottsbluff options will not encroach upon residences.

The Gering system alternatives AIN1, AIS1, AIV1, SDI, however, will require the use of land presently occupied by 15 residences as the Facility Plan for Gering points out. This would be a significant long-term adverse impact. In addition to the residents displaced, acreage adjacent to the 120 acre lagoon could experience a decline in sales value due to the proximity of a very large stabilization lagoon. Potential aesthetic and odor problems will act to inhibit residential development in the areas. With proper design and operation of the lagoon, odor problems should be minimal. However, public awarenesses of the lagoon's use could be the basis for a decline in aesthetic values in the immediate vicinity of the lagoon.

Table III-19 Non-Agricultural Land Use Changes
Resulting from Plant Siting Options

Alternative	Non-Agricultural Land Requirement (Acres)	New Land Use	No. of Residences Displaced	Land Made Available for Other Uses (Acres)
(Scottsbluff)				
CRN	0	-	0	0
CRS	0	-	0	0
CRV	0	-	0	0
AIN	10	Aerated Lagoon	0	0
AIS	10	Aerated Lagoon	0	0
AIV	10	Aerated Lagoon	0	0
SD1	0	-	0	125
SD2	12	Aerated Lagoon	0	0
SD3	12	Aerated Lagoon	0	0
SD4	0	-	0	0
(Gering)				
CRN1	0	-	0	0
CRS1	0	-	0	0
CRV1	0	-	0	0
AIN1	120	Stabilization Lagoon	15	0
AIS1	120	Stabilization Lagoon	15	0
AIV1	120	Stabilization Lagoon	15	0
SD1	0	-	0	0
SD2	5	Aerated Lagoon	0	0
AIN2	5	Aerated Lagoon	0	0
AIS2	5	Aerated Lagoon	0	0
AIV2	5	Aerated Lagoon	0	0
(Terrytown)				
T1	0	-	0	1
T2	0	-	0	0
T3	0	-	0	0
(Regional)				
Complete Regional	0	-	0	171
Joint Effluent Disposal by Retention	0	-	0	0
Joint Effluent Disposal by Irrigation	0	-	0	0
Joint Effluent Clarification up to 2	up to 2	Dissolved Air Flotation Equip.	0	1
Territory n to Scottsbluff or Gering	0	-	0	1

Actual reductions in site requirements are reflected in the Scottsbluff SD.1 alternative. The existing lagoons would be filled in and an activated sludge treatment plant constructed in their place. This action could leave 100+ acres of land available for other municipal uses. Also, if the Terrytown plant is abandoned, leaving only a pump station, that site would be available for other municipal uses. The same situation applied to Gering. Except for the anaerobic-aerobic industrial lagoons and a refurbished pump station, the Gering lagoons could be regraded back to original contours for municipal use.

Other alternatives available which affect the amount of non-agricultural land are the regional systems. In this category either plants at Terrytown or Gering or both would be abandoned and wastes pumped to a regional facility at Scottsbluff.

Due to the proximity of the existing wastewater treatment facilities to the flood plain of the North Platte, land for contemplated new treatment units may have to be located in or adjacent to the flood plain with possible encroachment on the river's wetlands. This land use problem is discussed in Section III.E.3.

d. Treatment Processes

Impacts resulting from the various treatment plant options on non-agricultural land use are the same as those described in Plant Siting since the land requirements are the same.

e. Effluent Disposal

Effluent disposal options include 1) complete retention and evaporation of the effluent, 2) land disposal by spray irrigation or ridge and furrow irrigation, and 3) stream discharge.

Factors which will result in impact to non-agricultural land use include commitment of land for force mains to the retention and spray sites. The disposal sites would all be located on what is currently agricultural land and so are considered in Section III.E.8.

Force mains to the retention and spray sites have been preliminarily located along roads. In doing so, this minimizes commitment of private lands for public use to the maximum extent possible. Short-term disruption of traffic on the force main routes will occur. On the basis of a 50 foot wide construction easement including a 20 foot wide permanent easement, the following are the acreage estimates for easements:

	Temporary	Permanent
North Site	81.2	32.4
South Site	42.4	16.9
Valley Site	12.1	4.8

Again, it should be mentioned that these pipelines are assumed to be along roads and that the actual easements could be less than those assumed above.

f. Sludge Handling and Disposal

Land requirements for sludge handling equipment at the treatment plant site are included in the Treatment Process category and are not considered here further. Disposal practices in terms of land use, however, are important to this discussion.

The disposal method is assumed to be landfill. All alternatives which incorporate effluent disposal by stream discharge yield varying amounts of sludge to be disposed of. There is no sludge associated with the complete retention and agricultural irrigation.

At an assumed 25 percent solids for vacuum filter cake the daily sludge production ranges from 4100 lbs or 6590 cu. ft. to 10600 lbs or 17044 cu. ft. depending on the type of wastewater treatment. These amounts equal a range from .15 acre feet to .24 acre feet of sludge to be landfilled daily.

The latest available estimates of landfill life expectancy shows Scottsbluff to be 10-15 years and Gering to be 20 years. However, no quantitative estimate can be made as to the effect of sludge disposal on the life expectancy of the landfills since information on operational procedures at the two landfills in the study area have not been determined.

g. Summary

Table III-20 provides a cumulative total of non-agricultural land use changes for each alternative.

Table III-20 Permanent Non-Agricultural Land Use Commitments (Acres)

Alternative	Collection System	Treatment Plant Siting	Effluent Disposal	Land Made Available for Other Municipal Use
Scottsbluff				
CRN	0	0	32	0
CRS	0	0	17	0
CRV	0	0	5	0
AIN	0	10	32	0
AIS	0	10	17	0
AIV	0	10	5	0
SD1	3	0	0	125
SD2	3	12	0	0
SD3	3	12	0	0
SD4	3	0	0	0
Gering				
CRN	0	0	32	0
CRS	0	0	17	0
CRV	0	0	5	0
AIN1	0	120	32	0
AIS1	0	120	17	0
AIV1	0	120	5	0
SD1	0	120	0	0
SD2	0	5	0	0
AIN2	0	5	32	0
AIS2	0	5	17	0
AIV2	0	5	5	0
Terrytown				
T1	0	0	0	1
T2	0	0	0	0
T3	0	0	0	0
Regional				
Complete Regional	2.7	0	0	171
Joint Clarification	4.0 ^a	0	2 ^a	0
Joint Retention	0.4	0	0	0
Joint Irrigation	0.4	0	0	0
Terrytown to Gering	3.6	0	0	1
Terrytown to Scottsbluff	0.4	0	0	1

a. The final figure will depend on the actual site chosen.

10. Local Economic Impacts

The types of impacts to the economy of the study area are as follows:

- Capital plus operation and maintenance costs to the major meat packing industries for wastewater pretreatment facilities,
- municipal tax loss resulting from conversion of private land to municipal land for treatment facilities and pipeline easements,
- changes in the industrial and municipal user charge rates to pay for the local share of grant eligible costs and operation and maintenance of the sewage treatment system.

a. Major Meat Packing Companies

In Gering the major meat packing companies, Swift and Stanko, would be required to bear the costs of controlling oil and grease in their wastewater. Assuming that additional equipment would be necessary to do this, private costs for installation and maintenance of pollution control facilities would be incurred. These costs would be required for all Gering and Regional alternatives. Costs of equipment may be partially offset by pollution control tax benefit programs of the state and Federal governments. If wastes removed from the wastewater are renderable, some return on the operating costs might also be realized.

In Scottsbluff the major meat packing company, Flanery Foods, is not constrained to provide pretreatment by technical considerations. However, for stream discharge alternatives, public costs to treat the mixed industrial and domestic wastewaters can be reduced if substantial waste load reductions are effected by Flanery Foods. As with Swift and Stanko, equipment and operating costs could be offset by tax benefit programs and rendering of collected solids.

b. Municipal Tax Losses

Removal of private property from the tax rolls is an adverse, long-term impact on the localities. Permanent easements for sewers and force mains and land purchased for treatment or effluent disposal facilities will remove varying amounts of land primarily from Scotts Bluff or Sioux County tax rolls. This cost to the County is not quantified here except that a one percent per year property tax loss was included as a cost in calculating net crop benefits for agricultural irrigation and complete retention alternatives.

c. Local Funding of Municipal Wastewater Treatment Facilities

A substantial proportion (87.5 percent) of capital improvement costs for study area sewerage systems will be borne by Federal and State construction grant programs. Local capital costs will be funded by an undetermined combination of municipal bonds, new sewer connection fees and user charges. Local operation and maintenance costs will be funded by user charges based on an ordinance to be reviewed in the construction phase. The overall costs to the municipalities are, therefore, highly sensitive to annual operating costs and are considerably less sensitive to capital improvement costs.

In order to evaluate the system and regional costs to Federal, State, and local governments, alternative costs are tabulated in Table III-22.1. Since the concern here is to evaluate the cost impacts to the local government, several detailed items listed in the alternative cost tables (Appendix Q) were treated differently in Table III-22.1. Specifically, these differences are:

Salvage value of land and equipment is not subtracted from capital costs. Column 1 is the actual expenditure expected during construction or rehabilitation of facilities.

Lost opportunity costs resulting from taking agricultural land out of productive use is not included as an annual

Table III-21

Federal, State, and Local Cost Comparisons by Alternative (Cost \$ x 1000)								
Alternative	Grant Eligible Costs			Local Cost				
	#1	#2	#3	#4	#5	#6	#7	#8
	Total	Federal Share (.75x#1)	State Share (.125x#1)	Local Share (.125x#1)	Present Worth O + M From Table	Total Present Worth (#4+#5)	Average Annual Cost (CRF x #6)	Cost to Treat #7 Design Flow x365 (c/1000 gal.)
<u>Scottsbluff</u>								
CRN	5855	4391	732	732	1206	1938	182.9	15.6
CRS	4803	3602	600	600	980	1580	149.1	12.7
CRV	3186	2390	398	398	651	1049	99.0	8.4
AIN	6631	4973	829	820	796	1625	153.4	13.0
AIS	5804	4353	726	726	531	1257	118.7	10.0
AIV	5381	4036	673	673	226	899	84.9	7.2
SD1	3352	2514	419	419	2595	3015	284.5	24.2
SD2	2163	1623	270	270	4248	4518	426.5	36.3
SD3	1326	994	166	166	2776	2942	277.7	23.6
SD4	837	627	105	105	1579	1684	159.0	13.5
<u>Gering</u>								
CRN	5988	4491	749	749	1220	1969	185.9	21.4
CRS	4640	3480	580	580	1043	1623	153.2	17.6
CRV	2955	2216	369	369	794	1163	109.8	12.6
AIN1	7094	5321	887	887	514	1401	132.2	15.2
AIS1	5697	4273	712	712	323	1035	97.7	11.2
AIV1	5057	3793	632	632	49	681	64.3	7.4
SD1	2340	1754	293	293	1854	2147	202.7	23.3
SD2	1579	1184	197	197	2193	2389	225.6	26.0
AIN2	6550	4912	819	819	885	1704	160.8	18.5
AIS2	5368	4026	671	671	694	1365	128.8	14.8
AIV2	4620	3465	578	578	420	1998	94.2	10.8
<u>Terrytown</u>								
* T1 G.	204	155	25	25	117	142	13.4	12.2
T2	32	24	4	4	243	247	23.3	25.5
T3	119	89	15	15	265	280	26.4	28.9
<u>Regional</u>								
Complete Regional	6590	4942	824	824	4894	5718	539.8	25.3
Joint Eff. Clarification	3303	2477	413	413	5265	5678	536.0	25.1
Joint Agricultural Irrig.								
North	11332	8499	1416	1416	1557	2973	280.7	13.1
South	10213	7660	1277	1277	1080	2358	222.5	10.4
Valley	9713	7285	1214	1214	504	1718	162.2	7.6
Joint Completion Retention								
North	10715	8036	1139	1139	2553	3692	348.5	16.3
South	9197	6898	1150	1150	2076	3226	304.5	14.3
Valley	489	4866	811	811	1579	2389	225.6	10.6

*Transport to Gering for treatment and disposal. Assumes a sewer service charge of \$.09/1,000 gallons.

cost. From a national economic perspective lost productivity is a real, quantifiable cost and was included in cost-effective analysis. However, there will be no actual cash flow for the municipalities resulting from lost agricultural productivity.

- By the same reasoning crop benefits taken as a 100 percent credit against O&M costs are simply the difference between expected harvest worth minus the annual cost of producing the harvest ("Irrigated Net Crop Benefit" in Table P-2). These crop benefits are not reduced by the amount of income expected from the existing crops at each site.

The result of this accounting approach is a dramatic change in the relative attractiveness of the alternatives. From a national, cost-effective point of view the least expensive system and regional alternatives are complete retention at the Valley or South sites and upgrading existing lagoon systems for stream discharge. However, from the local economic point of view the most attractive alternatives are agricultural irrigation or complete retention at the Valley or South sites. Stream discharge alternatives are consistently the most expensive due to high O&M costs. The shift in attractiveness is also due in large part to the high value of sugar beet harvests. Other crops or different assumptions about the market value of sugar beets will have a major effect on the relative local economic attractiveness of agricultural irrigation vs. complete retention.

For any of the system or regional alternatives, the impact of sewage facility improvements on system users will not be extreme.

Based upon the local costs to treat listed in Column 8 of Table III-21, the annual sewer service charge for a family of five generating 500 gallons of sewage per day would range from \$13.50 per year (7.4¢/1,000 gallons) to \$66.25/year (36.3¢/1,000 gallons). (These figures assume that all local costs for treatment are recovered as sewer use charges on the basis of flow. Neither repayment of outstanding municipal wastewater treatment bonds nor the Cities' administrative costs are included in the figures.)

The economic impact of paying sewer service fees would be felt most by low-income families. In 1970, 13.6 percent of the population in Scottsbluff, 11.5 percent in Gering, and an unquantified percentage in Terrytown, were in families living at or below poverty level. 1977 poverty level income for a family of five is \$6,810. Families at the poverty level will be paying 0.2 percent of their annual income for the least expensive alternative and 1.0 percent for the most expensive alternative.

11. Health Effects of Agricultural Irrigation

a. Aerosol Drift

Aerosol drift results when, during processes such as agricultural irrigation, lagoon retention, trickling filtration and wastewater aeration, the wind picks up and transports droplets of wastewater and the small solid particles that remain following the usually rapid evaporation of the liquid droplets. The mechanisms of droplet formation include considerations of nozzle pressure effects, liquid impacts on solid surfaces, and wind actions over water body surfaces. When a fine (0.2 mm or 200 μ m diameter) droplet of treated wastewater containing a typical suspended solids concentration of 20 mg/l evaporates, the residual solid particle's diameter is about 5 μ m, which is the commonly reported average size of aerosols sampled downwind of wastewater treatment facilities and is also small enough to penetrate to the lower respiratory tract (Sorber, et al., 1976).

Although the amount of particulate matter thus created is too small to be of general concern, and generally includes only small quantities of heavy metals, the occurrence of aerosol drift is of concern because of the possibility of associated pathogenic transmission. Bacteria, which themselves range in size between 0.3 and 15 μ m, may be found in fine liquid droplets, attached to solid particles, or individually airborne (Jacobson, et al., 1976). The vast majority of aerosolized bacteria is destroyed by the effects of solar radiation, desiccation, and perhaps other phenomena; however, such factors as the presence of radiation-shielding and moisture-holding particles, and the ability of many bacteria (such as the Aerobacter and Klebsiella types) to encapsulate themselves, act to insure the survival of some (Randall, et al, 1976). Table III-22 is a listing of the types of enteric (intestinal) bacteria identified downwind of activated sludge units by Randall and

TABLE III-22

TYPES OF ENTERIC BACTERIA IDENTIFIED
DOWNWIND OF ACTIVATED SLUDGE UNITS*
 (percent versus distance)

<u>Enteric Bacteria</u>	<u>Distance downwind from Activated Sludge Unit (ft)</u>			
	0	20	50	100
Enterobacteriaceae				
Aerobacter				
A. aerogenes	4.44	6.15	1.03	2.78
Unidentified	2.64	7.69	3.09	2.78
Arizona	0.00	0.00	0.00	0.00
Citrobacter				
Bethesda-Ballerup	0.14	0.00	0.00	0.00
Unidentified	2.22	3.08	2.06	0.00
Erwinia	0.00	0.00	0.00	0.00
Escherichia				
Alkalescens-Dispar	0.42	0.77	0.00	0.00
E. coli	2.64	3.08	1.03	1.85
Unidentified	4.44	6.92	2.06	0.93
Hafnia	0.42	0.00	1.03	0.93
Klebsiella				
K. oxytocolum	3.88	3.85	5.15	4.63
K. pneumonia	5.96	8.46	4.12	3.70
Unidentified	0.83	1.54	0.00	0.93
Proteus	1.11	0.00	1.03	0.00
Providencia	1.53	3.08	1.03	0.93
Salmonella	0.00	0.00	0.00	0.00
Serratia	1.94	1.54	1.03	1.85
Shigella	0.00	0.00	0.00	0.00
Unidentified	1.39	1.54	0.00	0.00
Non-Enterobacteriaceae				
Achromobacter-like	1.94	1.54	2.06	2.78
Aeromonas-like	4.99	0.00	0.00	0.00
Alkaligenes-Flavobacterium-like	47.71	47.69	67.01	64.82
Pasteurella-Actinobacillus-like	7.63	3.08	5.15	3.70
Pseudomonas-like	3.74	0.00	3.09	7.41

Note: Total numbers of isolates analyzed are 721 at 0 feet, 130 at 20 feet, 97 at 50 feet, and 108 at 100 feet.

Ledbetter, and indicates that percentages of some types vary with distance.

Bacteria types known or believed to be responsible for respiratory infections include Aerobacter, Escherichia, Klebsiella (K. oxytocolum equalling K. pneumonia in pathogenicity), Proteus, Pseudomonas, and Serratia (Briody, et al, 1974). Known or suspected enterically pathogenic bacteria types include Citrobacter (Bethesda-Ballerup), Escherichia (Alkalescens-Dispar), and Providencia (Randall, et al, 1976). Types of special concern that are believed to be present in sewage, such as Salmonella (for example, S. typhosa, which is responsible for typhoid fever) and Shigella (associated with dysentery), were probably not numerous enough to be found during the limited Randall and Ledbetter sampling program (Chanlett, 1973). In addition, though some epidemiological evidence indicates that viruses (which range in size from 0.015 to 0.45 μ m) may be carried by the wind over several miles, their recovery from outdoor air has proven difficult (Jacobson, et al, 1976). Though such pathogens as those described above are certainly present in the aerosols formed during various sewage treatment processes, and many experts are concerned about potential effects, there is no evidence of any resulting disease outbreaks.

The potential environmental impact of aerosol drift due to wastewater spray irrigation operations is difficult to evaluate with any accuracy because of the scarcity of pertinent measurements and the variability of conditions from one site location to another. Analysis of the available data indicates that, largely because only a small fraction of the bacteria contained in the wastewater being sprayed is aerosolized rather than being deposited on the ground or crop, and because only a small fraction of the aerosolized bacteria remains viable during downwind transport notwithstanding factors such as solar radiation and evaporative desiccation, the resulting ambient bacterial concentration is only about 0.003% of that which would be expected for a completely-aerosolized and non-decaying constituent. This conclusion is based on

the data of Sorber et al., but differs from their result because the downwind distance under consideration here is at least 500 feet from the effective center of the aerosol source. Their data were as follows: An average of about 100 bacteria per cubic meter at 152 meters directly downwind of a 34 meter wetted radius, 4.5 meter spray arc height, sprinkler releasing 35 liters per second of wastewater containing 3.7×10^8 bacteria per liter, and an average upwind or background ambient concentration of 28 bacteria per cubic meter. These data were obtained during the autumn in the Tucson, Arizona area for which the mean climatological wind speed of 8.1 miles per hour (Local Climatological Data, 1975) has been assumed to apply, and slightly unstable atmospheric dispersion conditions have been selected as being most representative of the hours of monitoring.

Based on a simple box-type dispersion modeling calculation for the onsite ambient bacterial concentration

$$X = \frac{0.003\%BI\sqrt{\pi A}}{2HW}$$

and the representative data of B (bacterial concentration in chlorinated wastewater) = 1.4×10^5 bacteria per liter (Sorber et al., 1976), I (rate of agricultural spray irrigation) = 25 inches per year, A (area under agricultural spray irrigation) = 1280 acres, H (height to which the aerosol drift is mixed into the air) = 10 meters (Turner, 1970) (based on an assumed atmospheric stability class D, the most commonly occurring class at Scottsbluff during the growing season) (National Oceanic and Atmospheric Administration, 1975) and W (wind speed through the mixed layer) = 10 miles per hour (the average observed at Scottsbluff during the growing season (NOAA) the expected concentration would be only 0.004 bacteria per cubic meter of air. The principal reasons for this low result are the effectiveness of wastewater chlorination (a bacterial reduction factor of almost 3,000) and the low expected long-term average irrigation rate equivalent to a factor of almost 500 below that of a continuously-operating 35 liter per second sprinkler wetting

an area with a radius of 34 meters .

The average bacterial concentration at more distant and densely populated locations, such as at Scottsbluff some ten miles from the proposed spray irrigation sites, would be very much less than 0.004 per cubic meter. The causes are: (1) infrequency of winds directed from the sites toward Scottsbluff.

With respect to the north site, the frequency of northerly winds is 7.6% on an annual basis; for the south site, the annual frequency of south-southeasterly winds is 3.6% (Nat'l. Oceanic & Atmos. Adm., 1975) (2) the greater height into the air the bacteria would be dispersed during their transport (the specific height depending on the atmospheric stability class) (Turner, 1970); and (3) the additional decrease in viability that may be expected to occur during that time. For example, experimental results show the survival of E. coli after two minutes in 55% humidity air to be 9.5%, and that of Serratia marcescens after two minutes in 49% humidity air to be 2.3%; for other species, the two minute survival at moderate humidities varies from near zero to 100% (Airborne Contagion and Air Hygiene - An Ecological Study of Droplet Infection).

The above analysis indicates that the probability of bacterial aerosol-induced disease occurring as a result of wastewater spray irrigation is very low. Very few bacterial aerosol particles would be expected to be deposited in the lungs, the nose or throat, or exposed wounds of any individual, and the likelihood of an infection resulting from the entry of a small number of bacteria is generally minimal (Williams, 1967). The predicted average bacterial aerosol concentration is almost four orders of magnitude below typical background levels, though the species present may differ considerably. With respect to the possibility of viral disease spreading through the atmosphere, the existing literature would seem to indicate that there is also little reason for concern; however, specific data regarding virus concentrations

are not available.

Notwithstanding the low probability of the occurrence of an adverse environmental impact due to bacterial aerosol drift from chlorinated wastewater spray irrigation, sufficient uncertainties exist to warrant considering the utilization of mitigating design measures. While the effectiveness of open buffer zones between the spray irrigation area and receptor locations of concern has not been reliably quantified, the existing data tend to support the conclusion that downwind bacterial aerosol concentrations (after the subtraction of background levels) are approximately inversely proportional to downwind distance. Densely planted buffer zones could be even more effective in reducing ambient bacterial aerosol concentrations, especially if the vegetation utilized is fine-leaved, a condition favoring aerosol impingement (Fuchs, 1964).

There are also operational measures available for the reduction of ambient bacterial aerosol levels. Since the existing data indicate that the highest bacterial concentrations occur at night, because of the absence of lethal solar radiation, the curtailment of operations at night, and probably even during daytime hours with little sunshine, may be expected to reduce the spread of viable bacteria (Goff, et al., 1973). Hours of stable atmospheric dispersion conditions (which occur on clear nights with low winds) and high humidities (which are more common at night) are especially unfavorable from an environmental point of view. While operation during high wind conditions may also be undesirable, the resulting increase in aerosolization may be counteracted by the increased atmospheric dilution accompanying high winds. Another operational control measure could involve the creation or temporary expansion of buffer zones by spray-irrigating only on interior site sections during unfavorable atmospheric conditions.

b. Accumulation of Pathogens from Scottsbluff Wastewater
Irrigation Alternatives

Another type of potentially adverse environmental impact is associated with the accumulation of pathogens on and around the crop being grown under the wastewater agricultural irrigation system, whether at the spray-irrigated north or south sites or at the surface-application irrigated valley site. The survival times of organisms deposited during the irrigation vary greatly, but may be considerable (Technology Transfer, 1976). Some examples are presented as Table III-23. Organisms may pose a hazard to field workers (for example, when they are engaged in the harvesting operation), others handling the crop and crop waste, and the ultimate consumers of edible crops. The degree of danger is highly dependent upon specific aspects of the operation.

For the Scottsbluff wastewater irrigation alternatives, water treatment and chlorination prior to its application will destroy the large majority of entrained organisms. Crops will not be grown for direct human consumption, those under consideration being corn for fodder and sugar beets to be converted to sugar before reaching consumers. Since sugar beet processing typically involves a one-hour lime-and-carbonation purification step under highly alkaline conditions (pH 11.1 to 11.4), and a 15 to 20 minute evaporation step at high temperature conditions (130°C), nearly all organisms present are likely to be destroyed, though data regarding the survival of viruses are not available (Personal communication, John Colberg, 1977). Individuals who come into contact with the irrigated land, crop or crop waste would need to exercise reasonable habits of personal hygiene in order to protect themselves against disease, in which case the results of available case studies regarding those handling sewage effluent support the conclusion that a health hazard would not exist (Technology Transfer, 1976). As mentioned previously, since the Scottsbluff effluent will be very low in heavy metal content, there is no

TABLE FII-23
SURVIVAL TIMES OF ORGANISMS¹

Organism	Medium	Type of application	Survival time
Ascaris ova	Soil Vegetables	Sewage AC ^a	Up to 7 years 27-35 days
B. Typhosa	Soil Vegetables	AC AC	29-70 days 31 days
Cholera vibrios	Spinach, lettuce Nonacid vegetables	AC AC	22-29 days 2 days
Coliform	Grass Tomatoes	Sewage Sewage	14 days 35 days
Entamoeba histolytica	Vegetables Soil	AC AC	3 days 8 days
Hookworm larvae	Soil	Infected feces	6 weeks
Leptospira	Soil	AC	15-43 days
Polio virus	Polluted water	—	20 days
Salmonella typhi	Radishes Soil	Infected feces Infected feces	53 days 74 days
Shigella	Tomatoes	AC	2-7 days
Tubercle bacilli	Soil	AC	6 months
Typhoid bacilli	Soil	AC	7-40 days

^aAC—Artificial contamination.

Source: EPA, 1976

danger that an adverse heavy metal accumulation may occur.

c. Aerosol Drift from Scottsbluff Wastewater Retention Alternatives

With respect to the potential for aerosol drift resulting from the passage of wind over the surface of stabilization, storage, or complete retention lagoons, much of the above discussion regarding aerosol drift from spray irrigation is applicable. Though a complete lack of ambient bacterial concentration data downwind of lagoons makes the expected impact impossible to quantify with any reasonable accuracy, a subjective comparison of the lagoons (as bacterial emission sources) to spray irrigation systems, as well as to trickling filters (Goff, et al., 1973) and activated sludge units (Randall, et al.), for which ambient bacterial concentration data are also available, has resulted in the conclusion that no significant health hazard is likely to occur. An additional mitigating design measure that may be employed in the case of bacterial emissions from lagoons is the minimization of the lagoon surface area over which the wind may act to produce aerosols. Minimizing the lagoon dimension parallel to the prevailing wind direction(s) may be most effective.

12. Air Quality

Air quality can be affected by the construction and operation of the sewage treatment facilities particularly if pollution control measures are not used. The types of potential air pollutants include particulates from construction operations; aerosols from aeration basins, ventilation systems, spray irrigation, and construction operations; odors that are noxious, and toxic or asphyxiating gases.

a. Construction Impacts

Construction activities associated with all of the alternatives have the potential to temporarily increase dust and other particulate levels. The soils in the Scottsbluff area are particularly susceptible to wind erosion when the surface is disturbed due to their fine texture and to the low rainfall of the area. Farming activities presently account for the majority of dust generation, and it is expected that without control measures, the sewage treatment facilities construction operation would not add significant amounts of dust to the atmosphere. Control measures, however, are necessary in order to minimize soil loss and other sources of particulates such as are described below:

Clearing, grubbing, and stripping - Control dust by water sprinkling and chemical treatment such as use of calcium chloride. Seeding may be effective. Light petroleum or bituminous surface treatment may be used.

Excavation, stockpiling earth, and embankment placement - Control dust by water sprinkling and chemical treatment. Seeding may be effective. Light petroleum or bituminous surface treatment may be used.

Cement and aggregate handling operations at mixing plants - Enclose operations and restrict to the most suitable location given land use and prevailing wind.

Haul road construction and maintenance - Control dust by water sprinkling and chemical treatment.

Smoke from burning cleared growth and scrap material - Use pit incineration to limit escape of particulates, especially if burning is permitted for debris disposal.

b. Operating Impacts - Aerosols

Aerosols and particulates can be considered jointly since they are airborne particles differentiated only by size. Aerosols are defined as suspensions of approximately microscopic, solid or liquid, particles dispersed in the atmosphere. Aerosols from treatment works are usually 10 microns or less in size. Particulates are, in general, considered to be liquid or solid particles of any size dispersed in the air. Foams, mists, dust, smog fumes, and smoke are among the different forms of aerosols and particulates.

Liquid aerosols are generated at treatment plants when bubbles of air from wastewater and liquid sludge burst and are discharged into the atmosphere. All aeration, ventilation, and spray irrigation activities involving wastewater or sludge are potential sources of aerosols. Activated sludge and aeration units -- particularly those handling raw wastewater

and spray irrigation equipment would be the major sources of pollution aerosols for the alternatives considered here.

Existing treatment facilities in Scottsbluff, Gering, and Terrytown are potential sources of aerosols. All alternatives under consideration will also be potential sources of aerosols because they employ aeration, spray irrigation, or are subject to foaming by waves (in large lagoons or retention ponds).

According to the U.S. EPA, research studies of aerosols from wastewater treatment works indicate that viable coliform bacteria have been found up to 0.8 mile from sources. E. Coli has an extremely short life span in aerosol form. However, coliform bacteria of the genus Klebsiella, form a capsule which apparently protects this organism from dessication in flight. While certain calculations have shown that inhalation of Klebsiella is possible at the downwind end of an aeration basin, no evidence has been found that aerosols have affected the health of either wastewater works operators or other persons (EPA, 1976).

Anaerobic digesters are included in Scottsbluff alternatives SDI, SD2; and Complete Regionalization. Gases produced in the anaerobic digester include methane, hydrogen sulfide, and nitrogen dioxide. The normal disposal method of these gases is to pipe them to a remote area of the site and burn them. Methane, when burned, produces carbon dioxide and water. Hydrogen sulfide converts to sulfur dioxide or trioxide and eventually to sulfuric acid. Nitrogen dioxide eventually is oxidized to nitrates.

Reuse of methane as a fuel for digester heating or diesel powered pump is a possible alternative to direct disposal. This reuse, while saving petroleum based fuel, still results in the same type of emissions.

c. Operating Impacts - Odor

Any organic material containing sulfur and/or nitrogen in domestic wastewater can, in the absence of an oxygen source, undergo incomplete oxidation, resulting in the emissions of byproducts which may be malodorous. For this reason, a major effort must be given to the prevention of odorant production and to the control of odors which can be generated accidentally, by the careful design and operation of wastewater treatment works.

The degree of obnoxiousness of malodorous gases depends not only on the concentration of the odor and on the person exposed to the odor but also on the intensity of the odor. Most people are particularly sensitive, and have greater acuity, to unfamiliar odors. Olfactory sensitivity varies from person to person. The olfactory senses of persons continually exposed to an odor become anosmic or insensitive to that odor with time; therefore, odor nuisance determinations are highly subjective. In fact, gases such as H_2S rapidly affect the olfactory senses to such an extent that, after a few minutes' exposure to even low concentrations, a person can no longer detect the H_2S . Potential sources of wastewater odors include:

1. fresh, septic, or incompletely treated wastewater
2. raw or incompletely stabilized sludge
3. raw or incompletely treated liquid process sidestreams
4. screenings, grit, and skimmings containing septic or putrescible matter
5. oil, grease, fats, and soaps from industry, homes, and street runoff
6. gaseous emissions from treatment processes, manholes, wells, pumping stations, leaking containers, turbulent flow areas, and outfall areas
7. chlorinated water containing phenols

There are innumerable odors in airborne gases and vapors resulting from various concentrations and intensities of each odorous constituent. As these odorous gases and vapors travel downwind, they often are neutralized (by counteraction) or to some extent intensified by reaction with other gases, vapors, or particulate matter.

Inorganic gases and organic vapors result from biological activity. The more common inorganic gases associated with domestic wastewater treatment facilities include hydrogen sulfide (H_2S), sulfur dioxide (SO_2), ammonia (NH_3), carbon dioxide (CO_2), methane (CH_4), nitrogen (N_2), oxygen (O_2), and hydrogen (H_2). Only hydrogen sulfide, sulfur dioxide, and ammonia are malodorous. (U.S. Environmental Protection Agency, 1976a).

Generation of toxic and malodorous gases is the result of permitting anaerobic conditions to develop. With the exception of sludge digestion in the various stream discharge alternatives and anaerobic treatment of industrial wastewaters, anaerobic conditions are avoidable by proper design and operation of facilities. Maintenance of a scum cover on anaerobic lagoons will avoid release of toxic and malodorous gases. Burning or use of digester gases for heating purposes can avoid releases of hydrogen sulfide, methane and ammonia gasses from anaerobic digestors.

An unusual situation exists at the Gering treatment plant. The wastes from the meat packing industries contain grease and oil which form a layer of scum on the anaerobic lagoons. Presently, this scum is removed periodically by burning. Alternatives for Gering include removal of most of the grease and oil, thus alleviating the air pollution. A layer of grease and oil is recommended to be left on the lagoons, however, to prevent odor problems from the lagoon.

Other odor prevention measures include aeration of wastewater during treatment, and minimizing pumping time of raw sewage in the collection system.

Based upon examination of daily low sewage flow metering records, the retention times of raw sewage in the existing collection systems appears to be less than four hours. Odor problems from raw sewage becoming septic prior to treatment are, therefore, not expected from most of the alternatives considered here. Possible exceptions would be the complete retention alternatives using the North or South sites. Transmission times for raw sewage, if it is pumped directly to these sites, could result in a highly septic condition and resultant odor problems at booster pumping stations or at influent structures to the complete retention lagoons.

Explosive, toxic, noxious, lachrymose, and asphyxiating gases found at wastewater works include chlorine, methane, ammonia, hydrogen sulfide, carbon monoxide and oxides of nitrogen, sulfur, and phosphorus. It is of the utmost importance that all precautions be taken to prevent the escape of such gases in hazardous or nuisance concentrations. Such gases are usually a greater detriment within wastewater treatment structures than in adjacent areas. (EPA, 1976) Ventilation systems can be incorporated into the design of treatment facilities which would minimize the possibility of a buildup of such gases. Monitoring ventilation discharges and providing means for destroying or neutralizing will minimize effects of gaseous discharges to surrounding areas.

Proper design of stabilization lagoons and complete retention ponds to keep BOD loads within acceptable limits (the Nebraska Department of Environmental Control standard is 25 lbs-BOD/acre-day) will avoid most odor problems except for brief periods in the spring after ice and snow cover melts. NDEC personnel (Personal Communication with Mr. Chester Culley, May, 1977) have found that odor complaints are normally received only when lagoons are seriously overloaded or when construction activities result in disruption of existing facilities.

d. Summary of Potential Air Quality Impacts

Table III-24 lists the alternatives and their potential for causing various air quality problems. Construction activities over large areas of land such as regrading existing lagoons and leveling sites for irrigation have a high potential for dust problems. However, this problem would be short-term and can be mitigated by the use of control measures described earlier. Aerosols have a high potential of forming in the complete retention ponds from wave action, and in other alternatives due to wastewater aeration.

Dissolved air flotation will release aerosols but dispersion will be limited because these units will be enclosed in buildings. Release of toxic or malodorous gasses is avoidable except as described earlier.

Table III-24

Potential for Air Quality Impacts Resulting from
the Operation of Sewage Treatment System Alternatives

Alternative (Scottsbluff)	Particulates	Liquid Aerosols	Gases
CEN	Low	moderate - wave action in pond	high { septic raw sewage in long pipelines; seasonal release of gases after ice cover melts on ponds
CES	Low	moderate - wave action in pond	high { septic raw sewage in long pipelines; seasonal release of gases after ice cover melts on ponds
CEV	Low	moderate - wave action in pond	high { septic raw sewage in long pipelines; seasonal release of gases after ice cover melts on ponds
AIN 1	Low	high - spray irrigation	high { septic raw sewage in long pipelines; seasonal release of gases after ice cover melts on ponds
AIS 1	Low	high - spray irrigation	high { septic raw sewage in long pipelines; seasonal release of gases after ice cover melts on ponds
AV 1	Low	low - ridge and furrow	high { septic raw sewage in long pipelines; seasonal release of gases after ice cover melts on ponds
SD 1	Low	low - no aeration	moderate - sludge digestion
SD 2	Low	high - aeration	low - no sludge digestion
SD 3	Low	high - aeration	moderate - sludge digestion
SD 4	Low	high - aeration	moderate - sludge digestion
(Gering)			
CEN	Low	moderate - wave action in pond	high { septic raw sewage in pipelines; seasonal release of gases after ice cover melts on ponds
CES	Low	moderate - wave action in pond	high { septic raw sewage in pipelines; seasonal release of gases after ice cover melts on ponds
CEV	Low	moderate - wave action in pond	high { septic raw sewage in pipelines; seasonal release of gases after ice cover melts on ponds
AIN 1	Low	high - spray irrigation	high { septic raw sewage in pipelines; seasonal release of gases after ice cover melts on ponds
AIS 1	Low	high - spray irrigation	high { septic raw sewage in pipelines; seasonal release of gases after ice cover melts on ponds
AV 1	Low	low - ridge and furrow	high { septic raw sewage in pipelines; seasonal release of gases after ice cover melts on ponds
SD 1	Low	high - aeration	moderate - seasonal release of gases after ice cover melts
SD 2	Low	high - aeration	low - aeration
AIN 2	Low	high - spray irrigation	high { seasonal release of gases after ice cover melts on ponds
AIS 2	Low	high - spray irrigation	high { seasonal release of gases after ice cover melts on ponds
AV 2	Low	low - ridge and furrow	high { seasonal release of gases after ice cover melts on ponds
(Terrytown)			
T 1	Low	none	none
T 2	Low	Low	low - offsite sludge processing
T 3	Low	Low	high - aerobic digestion, drying beds
(Regional)			
Complete Regional	Low	Low	moderate - sludge digestion
Joint Effluent Clarification	Low	High - aeration	moderate - sludge digestion
Joint Complete Detention	Low	moderate - wave action in pond	high - septic raw sewage in long pipelines; seasonal release of gases after ice cover melts on pond
Joint Agricultural Irrigation	Low	high - spray irrigation	high - seasonal release of gases after ice cover melts on pond

13. Noise

Noise will be generated by construction activities associated with the treatment facilities and certain functions of treatment plant operation.

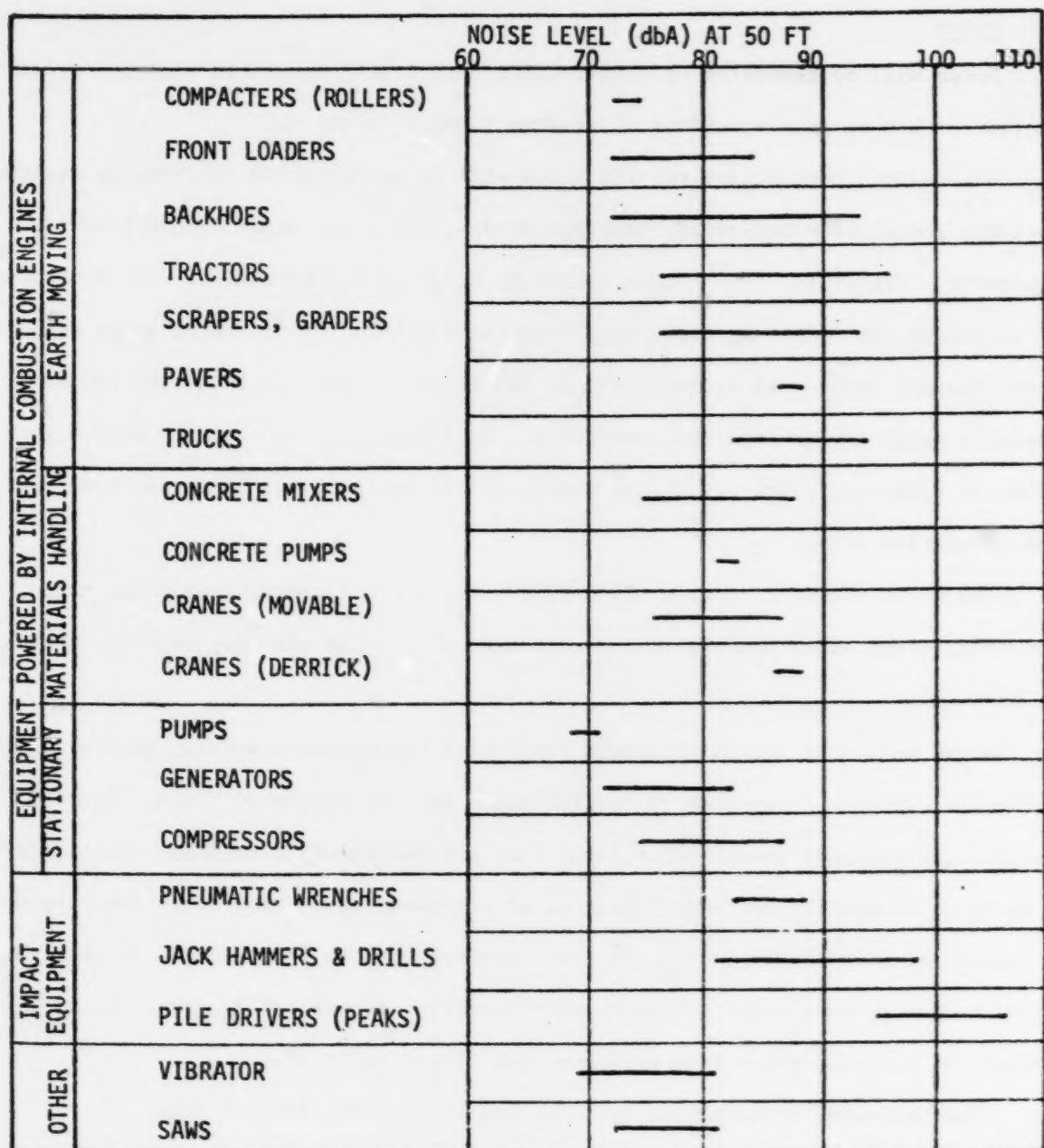
Generally, construction related noise will be generated by earthmoving equipment, portable pumps and compressors, concrete mixers, and other types of construction equipment. Figure III-11 shows ranges of noise levels associated with a variety of equipment that might be associated with the project. Proper muffling of exhaust from internal combustion engines will be the major factor in maintaining lowest possible noise levels from such equipment. Most construction activity will take place at treatment plant sites with lesser levels taking place along pipeline routes and irrigation sites.

The areas in which construction would occur are all remote from urban areas. Treatment plant sites and pipeline routes are not located near any schools, churches, or hospitals.

Noise generated within treatment facilities can be bothersome or harmful to the health of workers if measures to control noise are not employed. Table III-25 lists noise exposure levels for various time periods within a building. Table III-26 list each alternative and shows the type of equipment used which could generate noise in excess of acceptable limits. Control measures include installation of the least noisy equipment available. Other control measures, as described below, are effective methods of reducing noise from equipment and within buildings:

(The following is excerpted from EPA publication No. 430/9-7-003)

Piping Systems - Piping systems transmit noise through the fluid as well as along the pipe wall. Noise control measures include use of flexible hangers and resilient connectors, not connecting drainpipes from vibrating equipment rigidly to building drains, and use of wrappings and duct linings were appropriate. (Direct Environmental Factors at Municipal Wastewater Treatment Works, U.S. Environmental Protection Agency, 1976a)



NOTE: Based on limited available data samples.

Figure III-11. Construction Equipment Noise Ranges

Source: EPA Publication 430/9-76-003

Table III-25
Interior Noise Exposure Levels*

<u>Duration, hours/day</u>	<u>Maximum Sound levels, dBA Slow Response</u>	<u>Recommended Sound level, dBA Slow Response</u>
8	85	75
4	88	78
2	91	81
1	94	84
0.5	97	87
0.25 or less	100	90

* Personal protective equipment should be supplied and used whenever reduction in the levels in Column 3 of this table is not feasible.

Source: "Direct Environmental Factors at Municipal Wastewater Treatment Works" EPA, 1976.

Publication EPA-430/9-76-003

Table III-26
New Noise Generating Equipment

<u>Alternative</u>	<u>Piping</u>	<u>Lift Station</u>	<u>Other Pumps</u>	<u>Aerators</u>	<u>Vacuum Filter</u>	<u>DAS, DAF Blowers</u>
<u>Scottsbluff</u>						
CRN	Yes	Yes	Yes	No	No	No
CRS	Yes	Yes	Yes	No	No	No
CRV	Yes	Yes	Yes	No	No	No
AIN	Yes	Yes	Yes	No	No	Yes
AIS	Yes	Yes	Yes	No	No	Yes
AIV	Yes	Yes	Yes	No	No	Yes
SDI	Yes	Yes	Yes	Yes	Yes	Yes
SD2	Yes	Yes	Yes	No	Yes	Yes
SD3	Yes	Yes	No	No	Yes	Yes
SD4	Yes	Yes	No	No	Yes	Yes
<u>Gering</u>						
CRN	Yes	Yes	No	No	No	Yes
CRS	Yes	Yes	No	No	No	Yes
CRV	Yes	Yes	No	No	No	Yes
AIN 1	Yes	Yes	No	No	No	Yes
AIS 1	Yes	Yes	No	No	No	Yes
AIV 1	Yes	Yes	No	No	No	Yes
SD 1	Yes	Yes	Yes	Yes	Yes	Yes
SD 2	Yes	Yes	No	Yes	Yes	Yes
AIN 2	Yes	Yes	No	Yes	No	Yes
AIS 2	Yes	Yes	No	Yes	No	Yes
AIV 2	Yes	Yes	No	Yes	No	Yes
<u>Terrytown</u>						
T 1	No	No	No	No	No	No
T 2	No	No	No	No	No	No
T 3	Yes	No	Yes	No	No	No
<u>Regional</u>						
Complete Regional	Yes	Yes	Yes	No	Yes	No
Joint Effluent						
Clarification	Yes	Yes	Yes	No	Yes	Yes
Joint Complete						
Detention	Yes	Yes	No	No	No	No
Joint Agricul-						
tural irrigation	Yes	Yes	No	No	No	Yes
Terrytown to						
Scottsbluff	Yes	Yes	No	No	No	No
Terrytown to						
Gering	Yes	Yes	No	No	No	No

Valve noise may be appreciable at pressure reducing valve stations. Control measures include use of commercial mufflers, equipment enclosure, use of a diffractor to reduce turbulent flow, reducing the throttling velocity, and adjusting the orifice diameter and valve trim.

Mechanical Aerators - Noise from mechanical aerators consists of at least two components: noise from the equipment itself and splash noise. Pure tone whine could also occur from a noisy bearing. Because mechanical aerators are located in the open, they may be a potential noise nuisance to the community. Equipment selection should be based on an assessment of the community and the impact aerator noise will have on it. Control measures include proper maintenance to eliminate bearing noise, acoustically lined enclosure, or physical barrier surrounding the motor itself.

Compressors, Fans, and Blowers - Because of the intense, high pitched noise generated by this equipment, isolation in separate, acoustically insulated spaces is advisable. Mufflers may be placed on exhausts and/or intakes to control external noise. A plenum chamber may also be used to reduce external noise.

Vacuum Filter Pumps and Blowers - Noise from this source can best be controlled by isolating the pump in a separate room or on another floor from the filter equipment. Resilient pads and flexible piping connections will reduce transfer of vibration to the structure and piping system.

Pumps - Large pumps may generate noise exceeding the OSHA permissible noise limits. Control measures include sound absorbing enclosures and baffles.

HVAC - General control measures apply for most heating, ventilating, and air conditioning (HVAC) equipment. Ducts should be designed to reduce fan noise transmission as well as secondary noise generated by downstream air valves

and other devices. Fresh air intake and exhaust grilles at the building exterior must be designed to avoid excessive noise transmission to the neighboring community. Pressurized oxygen generator units used in oxygen activated sludge treatment systems may require enclosure to reduce noise levels.

Architectural Noise Control - Architectural noise control is accomplished primarily to absorption and isolation. Interior noise levels in occupied spaces should not be allowed to exceed levels listed in Table III-25. The more desirable 70-dBA design level will allow the speech and telephone communication necessary for safe operation. There are methods for determining noise levels in interior spaces if machinery noise output is available from the manufacturer. If machinery noise output information is lacking, the designer may estimate likely noise levels, identify potentially noisy equipment based on experience, and design appropriate noise control measures.

Because the alternative treatment sites in Gering and Scottsbluff are remote from sensitive receptors, noise impacts will be limited to exposure of treatment plant personnel. Such impacts can be adequately avoided by measures reviewed above. The Terrytown treatment site is close to existing residences, however. In particular, installation of air compressor for aerobic sludge digestion has the potential for adverse noise impacts. These compressors will be enclosed, thereby mitigating this impact.

14. Aesthetics

Aesthetic considerations, at the level of a Facilities Plan, are related primarily to the location of the treatment and disposal facilities and the types of treatment under study. Many subjects including air quality, odors, noise, and effects on land use, which are aesthetic in nature, have already been discussed in previous sections of this report. Visual effects of the alternatives will be the sole subject of this section.

Although the actual design of treatment and disposal facilities is a Step II task, the component options under consideration have general appearances which can be described. Whether an option uses an existing site or requires a new location may affect the desirability of that particular alternative since an intrusion will alter the aesthetic qualities of its surroundings. The following tabular presentation briefly points out the prominent characteristics of each alternative.

<u>Alternative</u>	<u>Major Visual Characteristics</u>
<u>Scottsbluff</u> C.R.N., C.R.S.	Existing plant used with minor modifications to distribution system. Effluent disposal to large pond (343-451 acres) in remote area. No public access available, area fenced.
C.R.V.	Existing plant used with minor modifications to distribution system. Effluent disposal to large pond (343-451 acres) in N. Platte River valley near Scottsbluff. No public access available, area fenced.

Alternative

- A.I.N., A.I.S. Existing plant used with additional 10 acres for an aerated lagoon and sludge drying beds. Effluent disposal via center pivot spray irrigation at remote sites previously not irrigated. No public access available, area fenced.
- A.I.V. Existing plant used with additional 10 acres for an aerated lagoon and sludge drying beds. Effluent disposal via ridge and furrow irrigation in North Platte River Valley near Scottsbluff.
- S.D. 1 Fill existing lagoons, build new activated bio-filter above ground plant with anaerobic digester. Stream discharge of effluent at existing site.
- S.D. 2 Existing lagoons used with additional 12 acres for DAF and screening equipment, aerated lagoon and anaerobic digester. Stream discharge at existing site.
- S.D. 3 Existing lagoons with 12 acres for aerated lagoon and vacuum filter for sludge. Effluent disposal to N. Platte River at existing site.
- S.D. 4 Existing lagoons and vacuum filter for sludge. Effluent disposal to N. Platte River at existing site.

Gering

- C.R.N., C.R.S. Use existing lagoons for industrial wastes, all wastes to large retention pond (355 to 751 acres) in remote area. No public access, area fenced.
- C.R.V. Use existing lagoons for industrial wastes, all wastes to large retention pond (355 to 751 acres) in N. Platte River Valley near Scottsbluff or Gering. No public access, area fenced.

Alternative

A.1.N.1,
A.1.S.1

Existing lagoons for industrial waste. Domestic waste to new 120 acre pond adjacent to existing site. Effluent disposal via center pivot spray irrigation at remote sites previously not irrigated. No public access area fenced.

A.1.V.1

Existing lagoons for industrial waste. Domestic waste to new 120 acre pond adjacent to existing site. Effluent disposal via ridge and furrow agricultural irrigation in N. Platte River Valley. No public access, area fenced.

S.D.1

Existing lagoons for industrial wastes. Domestic waste to new 120 acre pond adjacent to existing site. Vacuum filter sludge. Effluent disposal at present site on N. Platte River.

S.D.2

Existing lagoons for industrial waste. Domestic waste to new 5 acre aerated lagoon adjacent to existing site. Vacuum filter sludge. Effluent disposal at present site on N. Platte River.

A.1.N.2,
A.1.S.2

Existing lagoons for industrial waste. Domestic waste to new 5 acre aerated lagoon adjacent to existing site. Combined effluents to center pivot spray irrigation sites in remote area. No public access, area fenced.

A.1.V.2

Existing lagoons for industrial waste. Domestic waste to new 5 acre aerated lagoon adjacent to existing site. Combined effluents to center pivot spray irrigation sites in remote area. No public access, area fenced.

Alternative

Terrytown

- | | |
|-----|---|
| T-1 | Eliminate existing facility. Pump station on site to pump raw waste to Gering or Scottsbluff. |
| T-2 | Maintain and upgrade existing facility, offsite sludge disposal. |
| T-3 | Maintain and upgrade existing facility, sludge drying beds. |

Regional

- | | |
|---|--|
| 1. Complete Regionalization | Eliminate Terrytown treatment plant leaving a pump station. Eliminate Gering treatment plant leaving only a pump station. Refill Scottsbluff lagoons, replacing them with an above ground activated sludge treatment plant. Leaves land available for other municipal uses at all three sites. |
| 2. Joint effluent clarification and algae sludge processing | These facilities would be constructed at either Scottsbluff or Gering lagoon for stream discharge alternatives rather than at both. Small land requirement. |
| 3. Joint effluent disposal by complete retention | Separate treatment facilities as already described but joint disposal in one pond at North, South, or Valley site. Land requirements range from 742-808 acres. No public access, area fenced. |
| 4. Joint effluent disposal by agricultural irrigation | Separate treatment facilities as already described but joint disposal at North, South, or Valley sites. North and South sites would use center pivot spray irrigation. Valley site would use ridge and furrow irrigation. All sites fenced, no public access. |

Alternative

5. Inclusion of Terrytown Waste- water in System and Regional Alternatives

If Terrytown's wastewater is treated at Scottsbluff or Gering, the existing Terrytown plant would be abandoned. Only a pump station would remain. The land would then be available for other municipal uses.

Significant changes in visual appearance are associated with the complete retention alternatives. Very large ponds filled with sewage will be unusual additions to the landscape. The north and south sites are, however, remote. The valley site is much closer to Scottsbluff and more readily visible. Measures to minimize the intrusion would include landscaping and earthmoving. Also, the alternatives requiring a new 120 acre stabilization pond in Gering would have much the same impact as the valley site for complete retention. Visual appearance and public knowledge of its use could detract from its public acceptance.

15. Impacts on Archaeological and Historic Resources

a. Archaeological Resources

Structural facilities proposed in the various alternatives would not interfere with any identified archaeological sites. Investigation of the North and South sites did not reveal any potential for archaeological resources which would preclude proposed uses of the sites or require salvage efforts. Force main routes, the Valley Irrigation areas and Valley Complete Retention site proposed here in various alternatives have not been investigated for archaeological resources.

Except for investigations within the Scotts Bluff National Monument, the archaeological resources of the study area have been poorly inventoried. In light of the fact that the North Platte River valley has been a natural migration corridor for centuries, excavations for sewerage facilities could provide valuable opportunities for site discovery. Particular areas of concern are the first and second terraces above the river. Most of the river bottom is formed of the first Terrace with remnants of the older second terrace evident at the foot of the escarpment (third terrace) north of the river. The second terrace has yielded artifacts of great age in other parts of the valley (Kiowa Creek). The first terrace yields abundant hearths, flint implements and pottery shards as artifacts of more recent habitation. (Wenzel et al., 1946).

Because of the potential for disturbing archaeological resources, construction of new stabilization lagoons, storage ponds or complete retention ponds in these terraces should be preceded by thorough site investigations by professional archaeologists including exploratory digging. Construction of force mains in these terraces offers the opportunity for site discovery.

b. Historical Resources

The alternatives under evaluation do not impact any of the three National

Historic Register sites in Scottsbluff County. No alternative affects any of the known State of Nebraska sites listed in the Environmental Setting section of this report.

16. Impact on Recreational Resources

a. Parks

None of the alternatives under consideration are located in any designated city, county, state or national park. Further, no proposed parks are known to be affected by any of the alternatives.

The Oregon and Mormon Trails are currently under study for inclusion in the National Trails System. In the study area, these trails are found in an undisturbed state only within the Scotts Bluff National Monument. In most other areas, the trails have been obliterated by farming activities, urbanization, and flooding. It is therefore difficult to assess the impact of proposed facilities lacking a description or plans for the trails.

b. Recreational Zoning

A study of the Scotts Bluff County zoning map of February, 1974 indicates that the force main route to the north irrigation/complete retention site either crosses or passes close to land which is zoned for recreational uses in the Lake Alice area. As the pipeline route is only preliminary at this time, the extent of the impacts can not be described fully. The impacts will be related to construction and maintenance only, and will be short term in nature. No other areas zones for recreation are traversed by proposed facilities.

c. Sports Fishery

Chlorination of wastewater effluents discharged to the North Platte has not been included in stream discharge alternatives with the purpose of precluding toxic effects on migrating trout.

Discharge of drainage water from the North site to the headwater of Tub Springs Drain or Spottedtail Creek or from a North Valley Irrigation site to Winters Creek could adversely effect these trout spawning and nursery streams. The necessity to collect drainage water has not been fully established and alternative means of disposing of drainage water have not been developed.

17. Impact on Environmentally Sensitive Areas

a. North Platte River

A positive, long term benefit to the North Platte River will result from implementation of any of the alternatives. The complete retention and irrigation alternatives, of course, will yeild the greatest positive impact by completely eliminating wastewater discharge to the river. Stream discharge alternatives will result in lower nutrient levels in the effluent. The aquatic environment, by now adapted to the nutrient input from the effluent discharge, will readjust to the lower nutrient levels in the river.

b. Scotts Bluff National Monument

No impact to the Monument is expected since the project takes place entirely outside of the Park's boundary.

c. Wildcat Hills Game Preserve

No activities associated with this project will affect the Wildcat Hills Game Preserve.

d. North Platte National Wildlife Refuge

Construction of the force main to the north disposal site will result in a temporary impact at the western edge of the Lake Alice area. Noise, dust, and construction equipment exhaust emissions are expected, but the activity will be of short duration.

e. Tub Springs Creek

No pipelines crossing Tub Springs Creek are planned for any alternatives.

No runoff into the creek resulting from construction activities is expected.

f. Winters Creek

The force main to the north disposal site crosses Winters Creek near Scottsbluff. The stream appears to be channelized in the area of the crossing. Short-term sedimentation will result from disruption of the stream bed. Trout spawning activities occur in the upstream reaches of Winters Creek and will not be hampered by the temporary construction activities downstream providing the construction is timed so as not to occur during the spring and fall spawning seasons.

g. Agricultural Lands

Complete retention alternatives will remove from 296 to 1484 acres, depending on the alternative used, from agricultural use as discussed in the "Impact to Agricultural Lands" section of this report. Agricultural irrigation alternatives will remove from 397 to 841 acres, depending on the alternative used, from agriculture for holding ponds. An actual net loss of irrigated agricultural land will be realized if the valley areas are utilized since they are already irrigated. Use of the North and South sites for agricultural irrigation land disposal will represent an increase in irrigated land since they are presently not irrigated. This is discussed in detail in the "Impact to Agricultural Lands" section of this report.

Gering alternatives A.I.N.1, A.I.S.1, A.I.V.1, and S.D.1 will require 120 acres for a stabilization lagoon. Forty acres of this are assumed to be agricultural. The remaining 80 acres is owned by the City and is fallow. Over 140,000 acres of Scotts Bluff County are irrigated (Wenzel, et al., 1946). The addition or loss of up to 1484 acres represents approximately one percent of the total irrigated lands in the County.

h. Irrigation Canals

Force mains to disposal sites must cross several canals enroute.

Precaution will be taken in order not to disturb the canal prism. Tunneling may prove to be the safest means of crossing the canals. Alternatively, excavation through the canals and adequate replacement and grading during non-irrigation seasons would prevent disruption of their use.

i. Archaeological Sites

This subject is covered in detail under a separate heading in this report. It should be pointed out that any excavation into the first or second terrace could provide an opportunity for site discovery and examination by archaeologists.

j. Bluffs

The treatment plant locations are in the valley area and do not impact the surrounding bluffs. Force mains to the plateau in the center of the site would traverse bluff areas. The route and method of construction for this force main needs to be investigated in more detail to prevent destabilization of the bluff should agricultural irrigation of the North site be chosen.

k. Groundwater Resources

This subject is discussed in detail in a separate section of this report entitled "Impact to Groundwater Resources." In general, however, insufficient data on groundwater hydrology and quality in the study area precludes a quantitative discussion of effluent disposal impacts on groundwater.

F. SUMMARY OF ALTERNATIVES DEVELOPMENT AND EVALUATION

The numerous system and regional alternatives can be categorized into six basic courses of action:

- No Action -- Continue to operate existing municipal treatment plants in their present condition. As the contributing communities grow, the quality of effluent released to the river would continue to worsen.
- Limited Action -- Upgrade the existing treatment plants with modest structural modifications, and require pretreatment of industrial wastewaters from major meat processing plants. These changes would improve effluent quality to an unpredictable level. It is not expected that state effluent guidelines could be met reliably with this course of action.
- Stream Discharges from Upgraded Treatment Plants -- In addition to modest structural modifications of the existing treatment plants, new treatment units would be installed for Scott bluff and Gering. The new units would remove suspended solids particles from the lagoon effluents. Sludges generated from the effluent clarification units would have to be processed and disposed of.
- Stream Discharges from Activated Sludge Plants -- A new activated biofilter treatment plant would be constructed at the site of the Scottsbluff lagoon system. This course of action would permit greatest control over effluent quality. Sludges would have to be processed and disposed of.
- Agricultural Irrigation -- Lagoon treated effluents would be used as irrigation water for crop production. Direct effluent discharge to the North Platte River would be discontinued. 1,067 to 2,550

acres of land would be required for storage ponds, buffer zones, and irrigation acreage. A portion of the treated effluent would pass through the soil to the groundwater table.

- Complete Retention -- Wastewater disposal would be by evaporation to the atmosphere. 355 to 1,781 acres of land would be required to construct additional lagoons. Lagoon leakage could release treated wastewater to the groundwater table. Direct effluent discharge to the North Platte River would be eliminated.

A number of location, design, and regional variations of the last four basic courses of action are reflected in the many alternatives described in Chapter III of the Environmental Impact Section. An overview of the alternatives is given here by concisely stating the major environmental impacts, expected reliability, and implementation considerations of the six basic courses of action.

1. No Action

- a. Environmental Impacts

Adverse impacts of the No Action alternative include increased organic loading of the North Platte River, continued bacterial contamination of the North Platte River, increasing probability of odors at the lagoons, and continued periodic air pollution from scum burning from Gering's industrial lagoons. As with other courses of action relying on stream discharge, direct reuse of water and nutrients is not feasible, although extensive downstream irrigational use of the North Platte would result in partial, indirect reuse.

Minor changes in water quality would result from increasing organic loading on the North Platte River. Assuming that lagoon effluents would be stored during periods of very low flow in the river (i.e., below 168 cubic

feet per second = 7-day, 2-year low flow), the lowest dilution ratio for design wastewater flows would be approximately 18 to 1. Also assuming that significant deterioration of effluent quality will accompany increasing raw sewage input (effluent BOD loads increasing from 2,000 to 3,400 pounds per day; effluent suspended solids loads increasing from 3,200 to 5,000 pounds per day), the maximum increase in BOD and suspended solids concentrations would be 1.6 mg/l and 2.0 mg/l respectively. The increased suspended solids concentration will not be measurable against the high background of solids from other sources. Considering that the lowest dissolved oxygen concentration measured downstream at McGrew is 7.0 mg/l, an increase of 1.6 mg/l in BOD would not result in violation of water quality standards for dissolved oxygen.

Of perhaps more consequence, although less quantifiable, would be continued and increasing discharge of sewage bacteria to the North Platte River. Data indicating bacteria concentrations in the river and in effluent discharges is meager and does not support quantitative prediction of changes that might result from No Action. The North Platte River is classified as a "Partial Body Contact" stream on the basis of high fecal coliform bacteria counts, a situation which will not be improved by selection of the No Action course.

The lagoon systems are organically overloaded (37.5 lbs. BOD/ac.-day in Gering and 41 lbs. BOD/ac.-day in Scottsbluff) compared to Nebraska guidelines of 25 lb. BOD/ac.-day. The guidelines are set on the basis of odor control. Increases in organic loading that would accompany area growth would increase the probability of odor problems near the lagoons. Motorists on nearby traffic arteries will be the only sensitive receptors of odor problems unless new development occurs in the vicinities. The new highway

and river crossing is still being planned, but will be located east of the Gering lagoons.

No Action makes no provisions for controlling the scum buildup on the anaerobic industrial lagoons in Gering. Burning of the scum layer would result in periodic air pollution violations.

b. Reliability

The existing municipal wastewater treatment facilities are not meeting state effluent guidelines. In Gering and Scottsbluff there are no operational changes which, by themselves, will allow the facilities to meet effluent guidelines. There is a possibility that Terrytown's plant could meet guidelines for BOD and suspended solids if appropriate excess sludge handling and disposal practices were followed.

c. Implementation

All three municipalities are under orders to meet Nebraska Department of Environmental Control effluent discharge permit conditions. With the possible exception of Terrytown, failure to make structural modifications in existing facilities will result in violations of permit conditions. If Terrytown can solve its sludge disposal problem, a variance to the effluent guideline for fecal coliform would have also to be sought.

2. Limited Action

Upgrading the Scottsbluff and Gering lagoons by making several structural and operation modifications, including removal of suspended solids from the effluents is considered as the third course of action. The alternatives included in the third course of action represent the most reliable means of achieving state effluent guidelines.

It is possible that significant improvements in effluent quality

might be achieved with fewer modifications and less expense. In particular, elimination of dissolved air flotation processes and associated sludge handling and disposal processes would save approximately 30 percent of the capital cost and 45 percent of the O&M costs of complete upgrading alternatives.

The minimum structural modifications would be:

Scottsbluff:

- Refit pumping station and flow metering equipment
- Reroute flow of wastewater through the lagoons
- Construct new effluent outfall
- Require industrial pretreatment by Flanery Foods, Inc., including at least those pollutant removal efficiencies obtainable by screening and dissolved air flotation

Gering:

- Add new aerated or additional aerobic lagoons
- Require controlled removal of oil and grease from industrial wastewater

Limited Action could also be visualized as a phased approach to improving effluent quality. In the event that the minimum modifications fail to meet objectives, additional treatment processes such as effluent clarification or lagoon aeration could be added incrementally. Phasing would allow pilot testing of various effluent clarification processes prior to committing the substantial capital and O&M outlays for dissolved air flotation.

a. Environmental Impacts

Limited Action would result in improved water quality in the North Platte River relative to No Action. The greatest improvement is expected to be reduced bacterial contamination. This benefit would result mainly from

reduced hydraulic short circuiting of the Scottsbluff lagoons. It is doubtful, although unpredictable, whether Full Body Contact stream standards could be met with Limited Action. Dissolved oxygen, BOD, and suspended solids concentrations in the North Platte River will not be appreciably improved by Limited Action.

Limited Action should reduce the potential for odor problems near the lagoons, and would eliminate the air pollution caused by burning scum from the Gering industrial lagoons.

b. Reliability

The state of the art in wastewater lagoon design is not sufficiently developed to provide a basis for predicting treatment efficiencies for Limited Action alternatives. Step-by-step upgrading of the lagoon systems may result in prolonged violation of state effluent guidelines. An aggressive, well-planned program of wastewater, effluent, and stream monitoring, coupled with timely construction and evaluation of additional treatment units, could reduce overall costs, labor requirements, and energy demand in comparison to more comprehensive upgrading or replacement alternatives.

c. Implementation Considerations

In order to proceed with Limited Action alternatives, conditional variances to effluent guidelines would have to be sought from the Nebraska Department of Environmental Control. A rigorous monitoring program would be set up to provide information on the success of any limited actions.

No additional sites would have to be acquired for treatment units. Lagoons for the Gering system could be installed on land already owned by the City.

Acceptance of Limited Action alternatives may be facilitated by recently revised U.S. EPA policy allowing lagoon treatment facilities to discharge

suspended solids concentrations higher than 30 mg/l, if they can meet the BOD limitation of 30 mg/l. This new policy applies only to plants that discharge 2.0 mgd or less. Gering presently falls into this category, and Scottsbluff slightly exceeds it. Design flows for each city exceed 2 mgd.

3. Stream Discharge from Upgraded Treatment Plants

Complete upgrading of the existing wastewater treatment facilities would include all structural and operational modifications necessary to achieve secondary treatment levels. Dissolved Air Flotation (DAF) and associated sludge handling processes would be included to provide suspended solids removal from lagoon effluents.

a. Environmental Impacts

As with No Action and Limited Action, water quality impacts are limited to the North Platte River. Achieving an effluent BOD of 30 mg/l would result in a design year BOD load to the river of 1,500 lbs. BOD/day, compared to the present load of 2,000 lbs. BOD/day.

Increased operational efficiency should also result in reduced fecal coliform numbers in the effluents and in the river. Whether this improvement would allow reclassification of the river to a Full Body Contact stream is not known. Disinfection of effluents by chlorination has been ruled out due to possible toxicity to migrating trout.

Upgrading of existing plants would require additional land for some new treatment units. Generally, available areas around the plants are not in agricultural production. New units can be sited out of the 100-year flood-plain except at the Scottsbluff lagoons, where two to ten acres in the flood-plain might be required.

Avoidance of scum burning is accomplished by requiring oil and grease

removal from meat processing wastewaters by Swift Co. and Stanko, Inc.

b. Reliability

Dissolved Air Flotation (DAF) using chemical additions was selected for lagoon effluent clarification because it has been shown in some areas of the country to be the most effective and reliable. Like other effluent clarification methods, however, operating histories are not long. The process has not been tried in the Great Plains states. It is expected that this process, in conjunction with other lagoon modifications, will achieve secondary standards of effluent quality. The most likely time for violations of secondary standards would be during winter operations, when relatively high dissolved BOD in lagoon effluents might not be removable.

There does not appear to be any reason why the activated sludge plant serving Terrytown could not achieve secondary standards if excess sludge is properly controlled.

c. Implementation Considerations

Sites for new treatment units have not been selected. Site selection, and acquisition if necessary, should precede detailed design of new units.

As for all stream discharge alternatives, a variance from chlorination requirements will have to be sought by the municipalities from the State.

Due to the significant monetary, labor, and energy requirements of dissolved air flotation, pilot plant studies should be conducted for this and other effluent clarification processes should the stream discharge course of action be selected for Scottsbluff and/or Gering.

Sites for disposal of algae sludges will have to be identified and arrangements made for access and disposal.

4. Stream Discharges from New Activated Sludge Treatment Plant

With this course of action a new activated biofilter would be constructed to serve either Scottsbluff alone or all three municipalities. The plant would be located at the site of the existing Scottsbluff lagoon system and would be situated so as to impede flood flows as little as possible.

a. Environmental Impacts

The advantages of this course of action are that the flood obstruction caused by the Scottsbluff (and Gering, if the regionalized alternative is selected) lagoons will be much reduced and better control over effluent quality could be exercised.

Water quality impacts would be similar to those cited for Stream Discharge from Upgraded Treatment Plants. Differences between clarified lagoon effluents and activated biofilter effluent would be that lagoon effluents could have higher dissolved BOD concentrations in winter whereas activated biofilter effluents would have higher ammonia concentrations in summer. High summer ammonia concentrations are the basis for including additional nitrification processes. Thirteen percent of the capital cost and 16 percent of the O&M cost could be saved by not including the nitrification step.

Less acreage at the Scottsbluff site would be required for this course of action than for other courses of action. Regrading of the lagoons to original contours would make the surplus land available for other uses.

b. Reliability

The activated biofilter treatment configuration is a combination of proven unit processes. The ability to regulate the treatment process by adjusting aeration and flow recirculation rates insures the reliability of this course of action. Treatment units can be sized, piped, and located so as to facilitate plant expansion should it be necessary in the future.

c. Implementation

This course of action would result in disruption of the existing Scotts-bluff lagoon, possibly causing further degradation of effluent quality until new units are on-line. Planned phasing of lagoon elimination and new plant construction would be necessary to minimize this problem.

5. Agricultural Irrigation

The existing lagoon systems would remain in service with minor modifications. Discharges to the North Platte River would be eliminated. The lagoon-treated effluents would be chlorinated and pumped to a storage pond from which it would then be sprayed on cropland during the growing season. Four sites have been considered for the storage pond and cropland. Berms and diversion ditches would be installed to contain storm runoff and return it to the main storage pond for later reapplication on the cropland.

Applied wastewater would percolate through the soil into the natural water table or would form an artificial water table, depending upon geologic conditions. Substantial increases in total dissolved solids of the percolating water could necessitate reclamation and disposal of the drainage water. The need for reclamation and disposal has not been substantiated because of the absence of site-specific soils, geology, and groundwater data. Design considerations for reclamation and disposal facilities have not been established.

a. Environmental Impacts

Water quality of the North Platte River would be improved by elimination of the present discharges. The most notable improvement is expected to be in fecal coliform concentrations. Whether elimination of the local discharges would enable upgrading of the North Platte from Partial to Full Body Contact

cannot be predicted because of a lack of background fecal coliform data.

The environmental impact of most concern with this course of action is groundwater quality degradation. Localized increases in total dissolved solids from drainage waters and in nitrogen concentration from storage pond leachate are potentially the most significant groundwater impacts. Should agricultural irrigation be continued as the proposed action for Scottsbluff or the other municipalities, detailed site investigations would be necessary to determine the need for drainage water reclamation and disposal facilities.

Bacterial and viral contamination of local groundwaters is unlikely except where thin soils cover fractured bedrock or where groundwater mounding raises the water table to within five feet of ground surface. Local groundwater mounding does not appear to be a problem for the sites investigated, but thin soil types are present at the North Site, South Site, and South Valley Irrigation Area.

Atmospheric distribution of pathogens in aerosols formed during irrigation will not create public health problems. Chlorination of lagoon effluents prior to storage is included in this course of action as insurance against public health problems that might result from pumping station, force main, or storage pond failures.

Depending on the irrigation site selected, force mains might have to cross the North Platte River. One of these crossings, from the Scottsbluff lagoons to sites south of the river, would involve excavation through wetlands bordering the river.

The Scottsbluff and Gering lagoons would remain intact and would continue to be flood obstructions.

Total agricultural land required for effluent storage and disposal would be 1,067 to 2,550 acres. Of this acreage, 124 to 244 acres would be committed

to non-productive use for storage ponds. 786 to 1,922 acres would be used to grow crops. Agricultural productivity of this acreage at the North and South Sites would be greatly increased. Agricultural productivity of irrigated acres at the North and South Valley Irrigation Areas would remain high.

Agricultural Irrigation would result in direct reuse of up to 5 mgd of wastewater in the design year.

b. Reliability

The reliability of this course of action is dependent upon irrigation site conditions, adequate irrigation management, control of surface runoff, and appropriate groundwater monitoring. Irrigation management, runoff control, and groundwater monitoring are measures that are available with cost being the main limitation to their implementation. Site conditions are environmental "givens" and must be studied in detail as discussed below.

c. Implementation

Major implementation steps required are irrigation site analysis, site selection, and site acquisition.

Site analysis should include soil borings, percolation tests, soil compaction testing, soil cation exchange capacity, groundwater movement and quality studies, and sampling of all nearby wells.

Site acquisition is not limited to outright purchase by the municipalities. Long-term lease agreements and long-term effluent sales agreements are other possible arrangements. From a local cost perspective, the most attractive arrangement would be outright purchase of the land if only municipal wastewater treatment costs are considered. From a national economic perspective, long-term lease agreements appear to be most cost-effective based upon available data.

Site selection should be based upon economics and the ability to mitigate potentially adverse groundwater impacts, as indicated by the site analysis. Local opposition to agricultural irrigation with treated wastewater has centered on a number of concerns which have been addressed during the EIS process. All of these concerns have been answered except for the potential for adverse groundwater impacts.

Both the North Site and South Site have been cleared by the Nebraska State Historic Preservation Officer for construction of force mains and storage lagoons. Similar clearance would be required for the North and South Valley Irrigation Areas, if they are selected for use.

6. Complete Retention

Three sites have been reviewed for construction of sufficient new wastewater lagoons to achieve complete retention. Use of the North Site or South Site is clearly not cost-effective compared to use of a site in the valley near existing wastewater treatment facilities.

a. Environmental Impacts

Direct discharge to the North Platte River would be avoided with related impacts as discussed for Agricultural Irrigation

Percolation of wastewater through lagoon liners could cause groundwater mounding that could be a significant consideration in the Valley Complete Retention Area. Additions of nitrates and total dissolved solids to local groundwater is possible but could be mitigated at the Valley Complete Retention Area by installing toe drains around the lagoon dikes with discharge back to the lagoons or to the North Platte. Wastewater passing through the pond liner would be highly treated.

Whereas the new lagoons would be constructed out of the floodplain,

the existing Gering and Scottsbluff lagoons would remain in the floodplain.

Wastewaters would be lost for either direct or indirect reuse.

Land use at all three potential sites is agricultural. Wheat is grown on the South Site; the North Site is range land; and the Valley Site is permanent pasture. 355 to 1,781 acres of land would be committed to use as complete retention lagoons.

Average organic loadings of the complete retention lagoons are lower than the state design guideline of 25 lb.BOD/acre-day. As long as the raw sewage is properly distributed, there should be no odor problems from complete retention lagoons.

b. Reliability

The reliability of this course of action depends upon success in sealing the lagoon bottoms and adequately distributing the organic load. Soils at the alternate sites are coarse-textured, and would require special attention in lining the lagoons.

Sizing of complete retention lagoons is sensitive to assumptions regarding percolation through lagoon liners. An assumption of one-eighth of an inch of percolation per day reduces the design size of the new lagoons to one-half of that needed assuming no percolation. Undersizing lagoons would eventually result in spills from the lagoons. A sufficient amount of land should be acquired to provide for expansion of the lagoons. However, initial acreage developed into lagoons could be minimized until need for more acreage is proven by experience.

c. Implementation

Soil borings would be needed with testing to include soil permeability at various depths, compaction testing, and depth to bedrock or sand and

gravel beds. Depth to groundwater, groundwater movement, and groundwater quality would have to be analyzed.

Land acquisition arrangements would have to be settled for the selected site. Since the acreage would not be reclaimable without considerable expense, public ownership of the land is the only reasonable method of land rights acquisition.

The North Site and the South Site have both been cleared for construction of lagoons by the Nebraska State Historic Preservation Officer. The Valley Complete Retention Area has not been cleared, and so must be prior to federal funding for construction on the site.

7. Regionalization

Except for the No Action and Limited Action courses of action, opportunities for joint treatment and disposal of wastewaters are available to the three municipalities. The potential benefits of regionalization include reduced overall cost and reduced needs for skilled labor.

Regionalization alternatives considered in the EIS include:

- Complete Regionalization, relying upon a new 5.85 mgd activated biofilter treatment plant with effluent discharge to the North Platte
- Joint Effluent Clarification and Algae Sludge Processing
- Joint Effluent Disposal by Complete Retention
- Joint Effluent Disposal by Agricultural Irrigation

a. Environmental Impacts

Environmental impacts of the regional alternatives are the same as those discussed above for specific courses of action.

Disruption of wetlands bordering the North Platte River can be avoided by use of existing and planned highway bridges to support force mains connecting the separate sewer systems.

b. Reliability

Centralization of treatment processes should result in improved operation and control.

In other respects, the reliability of regional alternatives is the same as was discussed above for specific courses of action.

c. Implementation Considerations

Implementation of any of the regional alternatives would require formal agreements among the participating municipalities. Designation of a responsible agency to operate the joint facilities, development of an equitable cost allocation structure and ownership of land acquired for joint treatment and disposal should be elements of such an agreement.

Other implementation considerations applicable to specific courses of action as discussed above would also have to be considered.

G. COST SUMMARY OF THE SYSTEM AND REGIONAL ALTERNATIVES

1. Summary of Cost-Effective Analysis

Detailed cost-effective analyses were prepared for the system and regional alternatives developed in Section III. C. and D. The cost-effective methodology and assumptions are described in Appendix P. Detailed costs are tabulated for each alternative in Appendix Q. Local costs to treat are also included in the table and discussed in the next report section.

The total capital costs, design year operation and maintenance costs, and overall treatment cost per 1,000 gallons at design flow are ranked according to overall treatment cost for each municipality and for regional alternatives in Table III-27. Note that the costing methodology used does not include repayment of past debts or public works departments' administrative expenses, and does not incorporate the fact that the actual costs per

Table III-27.

Cost Summary of System and Regional Alternatives

<u>Alternative</u>	<u>Total Capital Costs^a</u> \$1000	<u>Design Year O&M Costs</u> \$1000	<u>Overall Treatment Cost</u> ¢/1000 gal.	<u>Municipal Costs to Treat</u> ¢/1000 gal.
Scottsbluff				
S.D.4 ^b	1269	161	23.74	13.5
C.R.V.	3186	64	28.74	8.4
S.D.3 ^c	1396	241	31.43	23.6
C.R.S.	4803	99	43.35	12.7
S.D.1 ^d	3352	245	46.46	24.2
A.I.S.	5804	69	48.71	10.0
S.D.2	2163	401	51.05	36.3
C.R.N.	5855	116	52.73	15.6
A.I.N.	6631	81	57.30	13.0
A.I.V.	5381	265	58.71	7.2
Gering^e				
C.R.V.	2955	77	38.28	12.6
S.D.2	1579	207	40.52	26.0
S.D.1	2340	175	43.74	23.3
C.R.S.	4640	104	57.79	17.6
A.I.S.1	5368	80	62.93	11.2
A.I.S.2	5697	45	61.40	14.8
A.I.V.1	5057	192	68.32	7.4
A.I.V.2	4620	227	68.81	10.8
C.R.N.	5988	117	72.64	21.4
A.I.N.2	6550	88	75.86	18.5
A.I.N.1	7094	53	76.44	15.2
Terrytown				
T.2.	32	23	28.50	25.5
T.1. to Gering	204	11	31.20	12.2
T.1. to Scotts- bluff	253	10	36.20	15.9
T.3	119	25	39.64	28.9
Regional				
R.C.R.V.	6489	154	33.43	10.6
R.S.D.2	3313	497	37.42	25.1
R.S.D.1 ^f	5709	387	42.00	---
R.C.R.S.	9197	209	46.69	14.3
R.A.I.S.	10213	136	47.98	10.4
R.S.D.1 ^g	6590	462	49.50	25.3
R.A.I.N.	11332	158	53.93	13.1
R.C.R.N.	10715	245	54.60	16.2
R.A.I.V.	9713	494	59.13	7.6

Table III-27 (cont'd)

- a Does not include present worth of salvage value
- b Includes private costs for dissolved air flotation and anaerobic-aerated lagoons at Flanery Foods, Inc.
- c Includes private costs for dissolved air flotation at Flanery Foods, Inc.
- d Without nitrification
- e Private costs of dissolved air flotation for Swift and Stanko wastewater not included
- f Without nitrification
- g With nitrification

1,000 gallons will change as flows to the treatment plant increase to the design year.

2. Summary of Local Costs

Because initial capital costs are heavily subsidized by state and federal governments while all operation and maintenance costs are borne by the municipalities and sewerage system users, alternatives having low O&M costs will create the least economic burden locally even if they require substantial capital outlays. This effect is particularly significant with agricultural irrigation alternatives, since crop benefits are credited against O&M costs. In addition, the crop benefit from a local point of view is the cash flow generated by the farming activities. Cash flow is greater than the crop benefit calculated in the cost-effective analysis, since the cost-effective analysis only recognizes the net increase in crop benefits from what is realized from present crops.

The results of the local cost analysis are expressed as "Municipal Costs to Treat" in cents per 1,000 gallons (¢/1000 gal.) in Table III-27. Note that these figures are not based upon the O&M costs listed in the same table, but on O&M costs reflecting cash flow as explained above. The alternatives most affected by the revised crop benefit assumptions are agricultural irrigation alternatives using a Valley site. These become the most economical alternatives for the municipalities because of the substantial crop worth.

3. Sensitivity of Agricultural Irrigation Costs to Assumptions About Land Acquisition

Three types of arrangements are considered for insuring the availability of agricultural acreage for the irrigation alternatives. These are:

- Case I -- Municipal Ownership of Irrigation Sites. This method of land rights acquisition was assumed in the 1975

Facilities Plan, the Environmental Assessments for the North and South Sites, and in the detailed costing of irrigation alternatives in this report. All farm management and crop production costs would be borne by the participating municipalities and all crop benefits would accrue to them. The municipalities will prepare the sites, and purchase and maintain distribution equipment.

- Case II -- Municipal Rental of Irrigation Sites. This method of land rights acquisition has not been previously considered. Ownership and possibly farm management responsibilities would remain with the landowner. Rents and farm management fees would be paid according to the following schedule:

	<u>Annual Rental Fee¹</u> <u>(\$/acre-year)</u>	<u>Management Fee²</u> <u>(\$/acre-year)</u>
North Site	5.20	40.00
South Site	30.00	40.00
Valley Areas	78.00	36.00

Crop production costs would be borne by participating municipalities, and crop benefits would accrue to the municipalities. The municipalities will prepare the sites and purchase and maintain distribution equipment.

- Case III -- Sale of Treated Wastewater. "Amendment No. 1 to Facilitation Plan of August, 1975 - Dissolved Air Flotation, Scottsbluff, Nebraska," recommended sale of treated effluent to landowners at the rate of \$6.50 per acre-foot. Site preparation, and purchase and maintenance of distribution equipment would be provided by the landowner. No crop benefits would be realized by the municipalities.

For all three cases the municipalities would be responsible for transporting effluent to the storage pond, site purchase, construction and maintenance of the storage ponds, and groundwater monitoring.

The effects of land acquisition assumptions on cost-effectiveness and local costs to treat have been estimated for the North, South, and Valley sites using Scottsbluff design and cost data. The results are tabulated in Table III-28.

¹Source: Mr. Robert Retzloff, Nebraska Panhandle Station, University of Nebraska.

²Source: University of Nebraska, 1976.

Table III-28

Overall Cost to Treat and Local Cost to Treat
for Three Cases of Land Rights Acquisition:
Scottsbluff Agricultural Irrigation Alternatives
(¢/1,000 gal.)

	<u>Case I</u>		<u>Case II</u>		<u>Case III</u>	
	<u>Overall</u>	<u>Local</u>	<u>Overall</u>	<u>Local</u>	<u>Overall</u>	<u>Local</u>
North Site	57.30	13.0	54.52	13.23	57.30	27.14
South Site	48.71	10.0	45.48	12.70	48.71	23.98
Valley Area	58.71	7.2	52.91	10.24	58.71	20.37

Renting of the irrigation acreage, Case II, appears to be more cost-effective than purchase of the land. This difference is based upon the fact that the present worth of renting land on those sites is less than the assumed cost of buying the land. Whether this cost saving would be realized in fact depends upon the agreements that the municipalities can reach with landowners. In the cost-effective analysis, Case III does not provide any cost advantages over Case I because the worth of the irrigated land and the net crop benefit still must be taken into account.

From the municipal cash flow perspective, complete control of the irrigation sites, Case I, is the most attractive option. Cases II and III are situations in which more of the productive value of the land is transferred to private interests.

Project 634

November 30, 1977

Draft

Environmental Impact Statement

Proposed Expansion of Existing
Wastewater Treatment Facilities --
Scottsbluff, Gering, and Terrytown, Nebraska

(Appendices A-R)

Approved by:

J. I. Bregman
President

Submitted by:

Gerald O. Peters, Jr.
Project Manager

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APPENDIX A

COMMENT LETTERS



Institute of Agriculture
and Natural Resources

THE UNIVERSITY OF NEBRASKA-LINCOLN
INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES
LINCOLN, NEBRASKA 68583

Reply to:
DEPARTMENT OF FORESTRY
201 Miller Hall, East Campus
Phone: (402) 472-2944
(402) 472-2984

February 25, 1977

Environmental Impact Statement Program
Environmental Protection Agency, Region VII
1735 Baltimore
Kansas City, Missouri 64108

Dear Sir:

Re: EPA Action, City of Scottsbluff, Nebraska

I have enclosed part of a paper presented by Loyd Fisher, Professor of Ag. Economics, University of Nebraska, on Municipal Sewage as an input in Tree Production. This paper was presented at the 27th Annual Meeting, Forestry Committee, Great Plains Agricultural Council, June 17, 1975, at Lincoln, Nebraska (Publication No. 76).

The use of trees may be a feasible alternative to get rid of waste in an environmentally sound method.

Possibilities for produced wood fiber would be:

- Sawlogs
- Conversion to livestock feed
- Heating supplement
- Chips for paper

I feel trees as the sewage irrigated crop should be considered as an alternative to irrigation of forage crops or at least as a supplement.

Sincerely,

Neal E. Jennings
Community Forestry Specialist
and Assistant State Forester

NEJ:11

Encl

cc: Mike Ferrill

Scottsbluff, Nebraska
February 28, 1977

Environmental Protection Agency
1735 Baltimore - Legion B11
Kansas City, Missouri.

Dear Sirs:

I am writing in regards to the Waste Water System being considered by the City of Scottsbluff, Nebraska, to an area north of the City. I am very much opposed to this as the 300 acre Waste Water Holding Pond is of great concern due to the pollution of wells in the area and a great Health Hazard.

It will be impossible to keep the Waste Water out of the wells and streams in our area due to the texture of the soil; it consists of light sand and hard pan, the area they are talking about putting the Holding Pond consists of light sand covering the hard pan, the water ^{will} get into these hard pan crevices and follow it right down to our wells and streams without purifying this waste water as the elevation of these holding ponds is much higher than the elevation of our wells.

I was always told that to purify water it should be run through a coarse sand ~~ground~~ (the soil has none of that) and if this is so all the wells north of Scottsbluff could be contaminated in time).

This is proven by the Pathfinder Irrigation Canal above us, as the water level in our wells raises considerably after the water is turned into the ditch in the Spring to fill the 3 lakes which are used for irrigation purposes.

I am an irrigation farmer who has operated 450 acres for 30 years, of which 200 acres are irrigated under the Pathfinder Irrigation District directly below the proposed project, I feel that I

am experienced in irrigation of this type of soil in this area to know that this project could be very dangerous to the pollution of wells and streams in this area and my neighbors who have lived here for years feel the same way.

I am one of the 250 persons who signed the petitions opposing this Project, which were presented at the meeting held in Scottsbluff on September 13, 1976.

When the men who make the study of this Project are in this area, I feel they should also contact the farmers who live in the area and are directly involved, they have a great amount of knowledge and experience in handling irrigation water on this type of soil.

The land that has been proposed for sprinkler irrigation is Native Grassland and should never be broken up for farming.

From what I have heard the parties who were interested in using the waste water for irrigation purposes have reconsidered and are not interested in it now.

I think the City of Scottsbluff is just looking for a site for their waste sewage whether it is to be used or not, and in time could have a holding pond of 500 acres or more, which could cause real seepage problems and be a real Health Hazard.

If the City of Scottsbluff goes ahead with this Project all the farmers in this area plan to have their wells tested and registered by the State before they start pumping and at regular intervals thereafter, and if any pollution appears somebody will be liable for a lawsuit.

I don't see why Scottsbluff, Gering & Terrytown
don't go together and build a good purifying
plant at the old site east of Scottsbluff, they
have coarse sand and gravel in that area and
the waste water will seep no other way but
down or be purified enough to be run into the
river.

I hope you will give this some consideration
as I am writing to you in good faith.

Sincerely

Arnor B Carlson
Scottsbluff Neb
Rt 1 Box 216

69361

RICHARD SCOTT

ATTORNEY AT LAW

1315 CENTER AVENUE

P. O. BOX 8

MITCHELL, NEBRASKA 69357

308-623-2600

March 1, 1977

Environmental Impact Statement Program
Environmental Protection Agency, Region VII
1735 Baltimore
Kansas City, Missouri 64108

Dear Sir:

I am taking this means to direct comments to you concerning the wastewater treatment facilities for the City of Scottsbluff, Nebraska. There are concerned citizens in Sioux and Scotts Bluff Counties. In Sioux County it is a well-known fact that tillage has not worked well in this area before and wouldn't even if there were waste lagoons. The water table is lower there and the growing season is as much as two weeks shorter than it is in Scotts Bluff County.

It has also been stated that the waste water would purify by seepage but there is hard-pan under the soil here so it will not seep far. If this waste water is so pure why can't it be dumped into the rivers? If it is not pure enough for the rivers then the citizens of these two counties certainly do not want it seeping into the underground water supply from which the water supply for many homes is drawn.

It is the hope of these individuals that it will be realized that there can be no land reclamation because of the poor tillage and that there is a definite possibility of contamination and its far reaching effects.

Very truly yours,



Richard Scott

RS:jw

cc: Merl Staman
Amos Carlson

RICHARD SCOTT
ATTORNEY AT LAW
1315 CENTER AVENUE
P. O. BOX 8
MITCHELL, NEBRASKA 69357

308-623-2600

March 1, 1977

Environmental Impact Statement Program
Environmental Protection Agency, Region VII
1735 Baltimore
Kansas City, Missouri 64108

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It is the hope of these individuals that it will be realized that there can be no land reclamation because of the poor tillage and that there is a definite possibility of contamination and its far reaching effects.

Very truly yours,

Richard Scott

Richard Scott

RS:jw

cc: Merl Staman
Amos Carlson

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Phone 402/432-2793

March 3, 1977

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1500 R STREET
LINCOLN, NEBRASKA 68508

Environmental Impact Statement Program
Environmental Protection Agency, Region VII
1735 Baltimore
Kansas City, Missouri 64108

ATT: Mr. Charles V. Wright
Acting Regional Administrator

Re: Wastewater Treatment Facilities
Scottsbluff, Nebraska
HP #3-005-77

Dear Mr. Wright:

The above project has been reviewed by this office to determine its affect upon properties enrolled in or eligible for inclusion on the National Register of Historic Places. The proposed storage pond site is in an area of extremely high archeological potential. We therefore are requesting that a survey by a trained archeologist be carried out before construction begins.

This office has the staff with the necessary expertise to carry out such a survey. We would require reimbursement of the actual costs and will send an estimate at your request. If you have any questions, please do not hesitate to contact this office.

Sincerely,

Marvin F. Kivett

Marvin F. Kivett
State Historic Preservation Officer

Richard E. Jensen

Richard E. Jensen
Curator of Historic Sites

RECEIVED
MAR 09 1977
ENGINEERING BRANCH
WATER DIVISION

pb
cc: Advisory Council on Historic Preservation

Scottsbluff Neb.

May 4, 1977

Environmental Impact Statement Program

Environmental Protection Agency, Region VII

1735 Baltimore

Kansas City, Missouri 64108

Gentlemen,

I (one of many in western Nebraska) am very much concerned as to the waste-water Plan that is being proposed by the City of Scottsbluff that is to be located about thirteen miles north of town. The 200 Acre holding pond would be about two hundred feet in elevation above the floor of most of our domestic wells. They say the pond would seal itself in time but they are going to put in bentonite to help seal it. Lake Alice is within two miles of this pond site and it seeps enough to form two large streams (one going Southwest & the other Southeast). This lake was built in 1911.

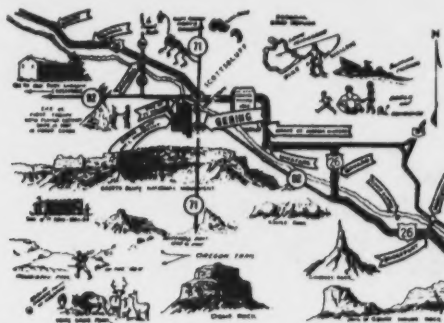
The hard pan formation, which there is a lot of in this area has very large crevices and once the water gets into them no telling which way it will go.

They keep telling us that it will be safe in every way, but there is always

that chance of human error and I
don't think the people in this area should
be put in the position that their drinking
water could be contaminated at any
time from this Project.

A very concerned resident &
landowner,

Merle L. Starnes



*North Platte Valley
Historical Assn., Inc.*

11th & J Streets
P. O. Box 496
GERING, NEBRASKA 68341

Phone
308-436-5411

March 7, 1977

United States Environmental Protection Agency
Region VII
1735 Baltimore
Kansas City, Missouri 64108

In regards to the city of Scottsbluff's proposal for waste water disposal through irrigation systems, it is the opinion of the North Platte Valley Historical Association that installation of such a system has been proposed both for the south side and north side of the river which eventually would be detrimental due to the seepage of impure water as we understand it to the extent of 30 inches per year, which is twice our normal rain fall. On the south side is a type of soil high in clay content plus sand which is adversely affected by too much water and there are quite a number of domestic wells that could be affected. The location of the storage basin is bound to cause seepage unless it is treated to prevent it with plastic, concrete or a suitable sealer. Also a storage basin would interfere with the natural surface flow. The location on the south side would take good wheat land and put it into feed crops. On the north side you will be able to show an increase in monetary value for the land would be changed from native dry land pasture to irrigated feed land crops. It seems to me that some other system of sewage disposal would be more beneficial to the North Platte Valley.

Sincerely,

Charles H. Scott

CHARLES H. SCOTT
Executive Director
North Platte Valley Hist. Assn.

RECEIVED

MAR 11 1977

CHS/dc
ENGINEERING BRANCH
WATER DIVISION

March 15, 1977
Mr. Burdette Kister
Route 1, Box 207
Scottsbluff, Nebraska

Environmental Impact Statement Program
1735 Baltimore
Kansas City, Missouri

Dear Sirs:

This letter is regarding the City of Scottsbluff, Nebraska which has applied to the Federal Government for financial assistance for extension of its wastewater treatment facilities to provide for land application of its effluent.

I will be making most of my comments about the proposed north site wastewater irrigation facility.

I live approximately two miles south of Section 26 in the proposed north irrigation site. I farm irrigated farm land in the area that is irrigated by a large irrigation canal which runs in an eastward direction about one half mile north of our home. I also own and operate 1,915 acres of grassland adjoining section 30 on the south side.

Concerning some of the major issues to be evaluated:

1. Possibility of surface and groundwater contamination and the resultant health effects. In relation to the surface water contamination: The proposed site for the storage pond would be west and north of Lake Alice and would be considerably higher elevation than Lake Alice, therefore, in event of a flooding type rain, which this area has been known to have, which could cause the storage pond to overflow or the dam to break. The effluent water would probably end up in Lake Alice which drains into Lake Minatare three miles downstream. Lake Minatare is a state recreation area. The odor from the storage pond would be very unpleasant for the people living and working in the area. The storage pond would be a natural spot for a breeding area for insects which would be very damaging to the cattle grazing and the people in the area.

In relation to the groundwater contamination: I think this is one of the most important issues at hand. The soil in the proposed storage pond and irrigation sites is very sandy in texture and the topsoil is very shallow. There is brule clay (hardpan) under the whole area including the storage pond and irrigation sites. The brule clay comes to the surface in many spots in the area and in most places it is not very far underground. Practically all the ground water wells in the area are dug into brule clay and find water from 20 to 80 feet deep. When the irrigation company turns water into the large canal in the spring, the water-table raises considerably in the wells. This proves that surface water has an effect on ground water in the area.

The surface water will run into the crevices in the brule clay then down to the ground water table. The brule clay has little aeration effect on the surface water. If the effluent water from the storage pond and irrigation sites would run into crevices in the brule clay, it could contaminate the ground water. This would definitely be a very serious matter which could also result in law suits.

2. Reclamation of the 1,480 acres of agricultural land for future use.

The land in the two proposed north irrigation sites is presently in native grass and has been years previous to this. The soil is very sandy and light and wind erosion has a very bad effect on this type of soil. Large blowouts can be seen on the proposed irrigation sites and also adjoining grassland. If this land would be broken out of sod for farming purposes, I'm afraid it would all blow away. The Eisele acreage has been with the present owners for only the last three years and to my knowledge have not been involved in a farming operation before this time.

Reproduced from
best available copy.

The L & M acreage, to my knowledge, is not owned by the L & M people presently, but they have an option to buy the land if this wastewater irrigation proposal would go through. They are not involved in farming at all presently, but more in the development and speculation type of operation.

All of the adjoining owners of grassland in the area are opposed to this proposal. They have owned their land for many years or lived in the immediate area for many years. The irrigation proposal was offered to all land owners in the area. They all turned it down except Eisele and L & M. Why?

The wastewater irrigation proposal can only work on a long term situation. Can the City of Scottsbluff be guaranteed a long term contract in this type of a situation?

3. Alternatives to the land application proposal.

I believe the City of Scottsbluff, Gering and Terrytown could develop a regional treatment system other than the land application method. Everybody within five miles near the north irrigation site is very much opposed to it. I hear the people in the area of the south irrigation site are much opposed to it also.

There are many cities in the United States with larger population than the combined population of these three cities which have treatment systems that use methods other than the land application method. I'm sure Scottsbluff, Gering and Terrytown could do likewise.

Sincerely,

Burdette Kuster



DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
CENTER FOR DISEASE CONTROL
ATLANTA, GEORGIA 30333
TELEPHONE: (404) 633 1311

March 23, 1977

Environmental Impact Statement Program
Environmental Protection Agency, Region VII
1735 Baltimore
Kansas City, MO 64108

Dear Sirs:

We have reviewed the notice of intent to prepare an environmental impact statement to extend the wastewater treatment capability for the City of Scottsbluff, Nebraska. Our comments concern the potential vector-borne disease impact which might result from this project.

The proposal to use sewage effluent for irrigation agriculture immediately raises the issue of vector mosquito production because two vector species found in that area, Culex tarsalis and Culex pipiens, have been found breeding in waters of a high organic content. Other species utilize this type of habitat as well. The introduction of sprayed sewage effluent has produced dramatic changes in mosquito population in another area of the United States, in that additional vector species appeared and the total numbers of mosquitoes increased as well. (Beaudoin, R.L. et al. Sewage effluent irrigation: impact on the mosquito populations of a woodlot. Proc. 61st An. Meeting New Jersey Mosquito Extermination Assn., 1974. pp 108-116.)

Numerous studies have shown the association of Culex tarsalis with agricultural irrigation, and this species is the vector of Western equine encephalitis (and St. Louis encephalitis in rural areas) in the western United States. Much of the breeding occurs as the result of poor drainage, and it would be imperative to plan for efficient distribution and drainage systems. Irrigation runoff commonly collects at the low end of the irrigated field, in roadside ditches, and borrow pits, and in drains that are poorly designed, constructed, and maintained. The use of a spray system negates some of these effects, but poorly managed application produces the same problems. The need for good design and planning to minimize the creation of mosquito larval habitats should be stressed during the early stages of the project.

A peculiarity of the North Platte Valley of Nebraska is that gravel terraces appear, probably resulting from glaciation. Some of these terraces are relatively near ground level and they contribute greatly to seepage problems. Water from unlined canals percolates along these gravel layers, eventually surfaces, and produces a seepage collection

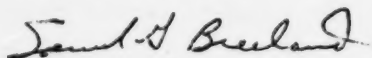
Page 2 - Environmental Impact Statement Program

which increases in size during the time of the irrigating season. The collection areas have been observed to grow in number yearly and it is estimated that some 2000 acres are lost to seepage. Seepage areas are producers of Culex tarsalis and Culiseta inornata (abundantly). For more detail on mosquito production in the Scottsbluff vicinity, we suggest you contact Mr. Jerry Taylor, Environmental Scientist, Scotts Bluff County Health Department, Gering, Nebraska, 69341 and Mr. William F. Rapp, Entomologist, Nebraska State Department of Health, 1003 O St., Lincoln, Nebraska 68509.

We are pleased to cooperate in the plans to develop the environmental impact statement, and if we can be of any further assistance, please let us know.

We will appreciate being placed on the mailing list to receive future notices on this project.

Sincerely yours,



Samuel G. Breeland
Chief, Medical Entomology Branch
Water Resources Activity
Vector Biology & Control Division
Bureau of Tropical Diseases

CC:

Mr. Jerry Taylor
Mr. William F. Rapp
HEW Region VII

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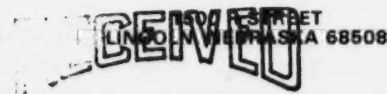


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March 28, 1977

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APR 04 1977

OFFICE OF THE DIRECTOR
WATER DIVISION

Charles V. Wright, Acting Regional Administrator
United State Environmental Protection Agency
Region VII
1735 Baltimore
Kansas City, Missouri 64108

RE: Scottsbluff, Ne., Wastewater Treatment Plant
HP #3-060-77

Dear Mr. Wright:

The letter of March 3, 1977, requesting a survey of the Scottsbluff, Nebraska, wastewater treatment facility can be ignored, as we were unaware that a survey of the northern alternative had been carried out. If you could send us any future survey results it would help us avoid other breakdowns in communications within our own professional community.

We concur with Dr. Agenbroad's recommendations for that area which he surveyed, that there would be no effect on cultural resources.

Sincerely,

Marvin F. Kivett
State Historic Preservation Officer

Richard E. Jensen
Curator of Historic Sites

lab

3/ 29/ 76

Page 1

Mr. Paul Walker
Federal E.P.A.
1735 Baltimore Ave.
Kansas City, Missouri
64108

RECEIVED

APR 6 1976

ENGINEERING BRANCH
WATER DIVISION

Dear Sir:

After our phone conversation (Tues. 3/ 23/ 76), and rereading the public hearing records, I would like to go over our conversation about the Scottsbluff Wastewater Irrigation facility in writing.

I believe I am qualified to discuss the engineering problems which occur from an irrigation project, as I did receive my B. S. of Ag. Engineering from the University of Wyo. in 1966 and I have been farming several types of soil in the last 8 years. Therefore, besides the fact that there will be a seasonal odor, and that none of the landowners in the area of site #2 (approx. 7 mi. SE of the present Scottsbluff lagoons) want to sell their land; I would like to go over some of the possible problems which could make this a dangerous encroachment of the environment of the Creighton Valley watershed area.

Economically I feel that the production of wheat for human consumption is of greater value to the Scottsbluff area and the world, then is the production of crops which can only be fed to livestock, which according to the prices paid to the farmer must already be in an over supply situation.

Also as I mentioned before the land in site #2 is all in the Creighton Valley Watershed area, which is subject to sever thunderstorms, which have sent flood waters down through the town of Melbeta several times. We do have films and pictures to document some of these floods.

Another problem is that if an irrigation project is put in the area of site #2 and sprinkles 20 inches of additional water onto our fine Mitchell Valley Silt Loam Clay soil which has a Brule clay (hardpan) underlay, it will very soon become saturated and runoff and floods through the area and the town of Melbeta will be more frequent and cause a lot more crop and road damages. When this saturated condition occurs runoff is going to occur without the help of any rains, as much of this land is hilly and the hardpan comes to the surface in many places. Lewis creek and Muddy gulch are the local terms given to the system that drains the Creighton Valley area and runs directly into the North Platte River.

Seep is a problem that will effect most of the surrounding farms and will also cause an economic loss to the valley. This occurs because of the hardpan underlay, and is already some what of a problem from our existing irrigation projects. The worst area is Cochrans Lake. This lake was not planned and didn't occur until after irrigation came into the area. A road had to be moved because of this seep area.

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The most important consideration given to us by Mr Wells was of the cost effectiveness of the program. The sad part of this was that Mr. Wells got a poor appraisal. They valued the land in both sites at the same price which is differently not true. Grass land like we have in site #1 sells for \$100.00 ~~to~~ 150.00 per acre and the wheat land in site #2 sells for \$300.00 = 400.00 per acre.

Therefor:

SITE #1 $\$150.00 \times 1480 A. = \$222,000.00$
 SITE #2 $300.00 \times 1480 A = \$444,000.00$

This gives us a land cost difference of \$222,000.00 or a cost effectiveness of site #1 over site #2 of \$22,000.00 according to the figures quoted in the public hearing minutes of 2/ 23/ 76 at Scottsbluff.

Also the sale of this land to Scottsbluff would mean a loss to the school dist. #31 of \$1800.00 in taxes for the Scottsbluff sewage system alone, and we understand that the Gering and Terrytown systems have to go in with Scottsbluff which would mean an immediate doubling of the system.

As a group of concerned citizens we know that the large cities have a problem and that the land application of sewage to fully use its potential is a good idea, but we don't want to see the city of Scottsbluff and the E.P.A. make a mistake and ruin some already productive soil as well as the environment and economy of an entire area, when there is a more cost effective site that has a soil type which will absorb this much water and utilize it much better by actually turning grass land into productive crop land. Also a land owner in the area of site #1 has expressed a desire to use this type of irrigation.

If there are any questions you have about our area or if you would like to look at our area and pictures, we would be happy to show them to you if you would call or drop me a card. Also we feel that Bob Cox (who is on the State of Nebr. E.P.A. board from this area) may have a conflict of interests as he is a land and housing developer in the Scottsbluff area.

Sincerely:

Committee of concerned citizens

by Richard Gatch

Richard Gatch

Rt. #1
 Gering, Nebr.
 69341

Phone: 303-783-1190

cc. Committee of concerned citizens
 cc, Richard Gatch



STATE of NEBRASKA

DEPARTMENT OF HEALTH
DIVISION OF HOUSING AND ENVIRONMENTAL HEALTH
301 CENTENNIAL MALL SOUTH
P.O. BOX 95007
LINCOLN, NEBRASKA 68509

April 11, 1977

Mr. Edward C. Vest
Environmental Impact Statement Coordinator
U.S. Environmental Protection Agency
1735 Baltimore
Kansas City, Missouri 64108

Re: Scottsbluff Wastewater Treatment

Dear Mr. Vest:

We have reviewed the letter written by Dr. Samuel G. Breeland on March 23, relative to the use of sewage effluent for irrigation.

Studies conducted on a period of years have shown that Culex Tarsals and Aedes Dorsals are the dominant mosquitoes in this area of Nebraska. It is highly doubtful if this type of irrigation would cause a Culex Tarsals breeding problem as the species require long time standing water. We believe that any fields or pastures which are irrigated by sewage should be leveled so that there are no pools or depression areas. If the irrigated areas are level and good drainage is provided we see no mosquito breeding problems.

It is our understanding that the proposed area for sewage irrigation is in the river valley. Geologically, this is White River group (Oligocene) and is composed of silty clays and sands to a depth of 250 to 500 feet. Soil studies should be conducted in order to determine if there is any possibility of the sewage effluent reaching a water table which is used for domestic supply.

We believe that a great deal of care in the construction of the project is necessary in order to prevent mosquito breeding. This area at the present time has a very high mosquito population which is closely associated with present irrigation practices.

It is strongly recommended that you consult with Mr. Jerry Taylor, Director of Scotts Bluff County Health Department, Court House, Gering, Nebraska 68509.

Mr. Edward C. Vest
Kansas City, Missouri 64108
Page 2.

We would appreciate being placed on your mailing list to receive future notices of projects in Nebraska.

Very truly yours,

William F. Rapp, Jr.

William F. Rapp, R.P.E.
Entomologist
Housing and Environmental Health

jkh

cc: Dr. Samuel G. Breeland, Bureau of Tropical Diseases
Building 23, C.D.C., Atlanta, Georgia 30333

Gerald O. Peters, Jr., WAPORA, Inc., 6900 Wisconsin Avenue, NW
Washington, D.C. 20015

Jerry Taylor, Scotts Bluff County Health Department, Court House
Gering, Nebraska 68509



DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
CENTER FOR DISEASE CONTROL
ATLANTA, GEORGIA 30333
TELEPHONE: (404) 633-3311

April 27, 1977

Mr. Edward C. Vest, Coordinator
Environmental Impact Statements
U.S. Environmental Protection Agency
Region VII
1735 Baltimore
Kansas City, Missouri 64108

Dear Mr. Vest:

Thank you for your letter of March 30, 1977, regarding the proposed irrigation project utilizing sewage effluent from Scottsbluff, Nebraska. As requested, we have attached a copy of "Sewage Effluent Irrigation: Impact on the Mosquito Populations of a Woodlot", by Beaudoin et al. WAPORA, Inc., will also be furnished a copy of the reprint.

As you may know, the Center for Disease Control has performed numerous mosquito studies in the North Platte Valley of Nebraska, and Water Resources Activity has the reports of these studies on file. One such report is enclosed for your information because sources of mosquito production for that locality are described. Please feel free to photocopy any part of the report that might be of use to you. We ask that you kindly return our copy.

If we can furnish additional information, please contact us.

Sincerely yours,

Samuel G. Breeland
Water Resources Activity
Chief, Medical Entomology Branch
Vector Biology & Control Division
Bureau of Tropical Diseases

Enclosures

cc: WAPORA, Inc. w/enclosure

United States Environmental Protection Agency
Region VII
1735 Baltimore
Kansas City, Missouri 64108

Re: Proposed South Site
Wastewater Irrigation Facility for
City of Scottsbluff, Nebraska

This letter is in response to the major issues to be evaluated in the EIS.

1. Possibility of surface and groundwater contamination and the resultant health effects.

The storage lagoons are over the water source for this valley. The water depth is approximately the same at all farms in this area. The effects of ponding is already evident, due to irrigation, near the proposed site. The formation of Cochran Lake resulted when irrigation was first introduced into this valley. The possibility of other lakes forming is present if irrigation in the amount stated in Mr. Wells study is applied south of the present irrigated farms.

"Hepatitis viruses, Endamoeba histolytica cysts, and tapeworm eggs withstand the chlorination treatment generally applied to waste-treatment effluent. Irrigation water may be sprayed over crops, flow-through channels in fields and seep to roots, or be flooded over the field. The number of pathogens applied during irrigation can be of such magnitude that outbreaks can result. During an epidemiologic investigation Renteln and Hinman found that sewage plant effluent used to irrigate a field was channeled by gopher holes to a well pit and entered a community water supply through a defective well casing. Aerosols will be produced during spraying and pathogens trapped in the aerosols may be conveyed to locations other than the irrigated fields by wind and air currents." Frank L. Bryan Center for Disease Control

The irrigated farms north and east of this site produce beets, beans, corn and alfalfa. The winds during the summer months are from the south and west in this area.

2. The effect of Scottsbluff irrigation runoff on the community of Melbeta could be very disastrous. The only downstream outlet for any surface water runoff of the irrigation site is along the west side of Melbeta and is already a problem spot of flooding in any fast runoff from the Creighton valley area.

3. A regional wastewater treatment system for Gering, Scottsbluff, and Terrytown, Nebraska, could be very feasible with the treated water being returned to the North Platte River without the use of any extra expense and power to pump the water any great distances.

4. There is no need for reclamation of the 1480 acres of good agricultural land for future use. The 1480 acres are at present producing above average wheat yields. If 1480 acres are needed for the disposal of sewer water the North Site is a low producing native grass land and has unlimited area for later expansion if needed. The South site is very limited for expansion.

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5. Mr. Wells now has an alternative to the land application. We hope he has been in contact with the G.P.A. by now. According to Mr. Wells the air flotation system is more cost-effective than the land application system. His cost figures for the flotation system is between \$2.3 million to \$3 million compared to the \$4.2 million for the irrigation system; with operating costs about the same. He also said that it is possible that Scottsbluff and Gering could utilize the same system.

We hope this letter will be of some use. If there are other questions or answers needed please let us know.

Harvey Dutton

Creighton Valley-Melbeta Committee
Route 1 Box 144
Gering, Nebraska 69341



United States Department of the Interior

FISH AND WILDLIFE SERVICE

WASHINGTON, D.C. 20240

ADDRESS ONLY THE DIRECTOR,
FISH AND WILDLIFE SERVICE

JUL 6 1977

In Reply Refer To:
FWS/OES Sp.

Mr. Edward Vest
Environmental Impact Statement
Coordinator
U.S. Environmental Protection Agency
Region 7
1735 Baltimore
Kansas City, Missouri 64108

Dear Mr. Vest:

This letter acknowledges receipt of your evaluation of the Scottsbluff, Nebraska water project on the whooping crane. Your concern about compliance with Section 7 of the Endangered Species Act of 1973, is appreciated.

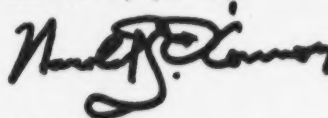
The Service has proposed Critical Habitat for the whooping crane which was published in the Federal Register on December 16, 1975. We are now in the process of finalizing Critical Habitat for the whooper and anticipate a final determination in the near future. The water project area is not located within any areas currently being considered for Critical Habitat of the whooping crane.

If, after your further review of the project, you become aware that the project may adversely affect the whooping crane or its habitat, we suggest that you request Section 7 Consultation with our Denver Regional Director, Mr. Harvey Willoughby, 10597 West Sixth Street, Denver, Colorado 80215, Telephone 303-234-2209.

The consultation would then be carried out as contained in the Service's "Guidelines to Assist the Federal Agencies in Complying with Section 7 of the Endangered Species Act of 1973" (copy enclosed).

We are hopeful that this will be of assistance to you. Please contact our Denver Regional Director or this office, if we can be of further help.

Sincerely yours,

A handwritten signature in dark ink, appearing to read "H. J. [unclear]", written in a cursive style.

Acting Associate Director

Enclosure



United States Department of the Interior
FISH AND WILDLIFE SERVICE

IN REPLY REFER TO:

AREA OFFICE: SOUTH DAKOTA-NEBRASKA
POST OFFICE BOX 250
PIERRE, SOUTH DAKOTA 57501

July 20, 1977

Mr. Edward Vest
Environmental Impact Statement Coordinator
Environmental Protection Agency, Region VII
1735 Baltimore
Kansas City, Missouri 64108

Dear Mr. Vest:

This responds to the May 16, 1977, letter signed by Mr. Charles H. Hajini regarding a proposed sewage treatment facility at Scottsbluff, Nebraska. The letter and attachments indicate that proposed alternatives include complete retention or irrigation with treated effluent. The latter alternative includes two proposed irrigation sites, one north and one south of the North Platte River.

It will be necessary to have detailed information on the project before we can make a definite recommendation. However, based on review of preliminary data we see no major problems with either of the proposed alternatives. This preliminary opinion includes both North Platte River flows and endangered species.

If the alternative of irrigating land south of the river is selected, vegetative disturbance along the route where the force main would cross the river should be held to a minimum. Wetlands as defined in "Wetlands of the United States", (Circular 39), 1971, USFWS, should be avoided no matter what alternative is selected. The EIS should clearly indicate whether any wetlands will be involved in the selected project.

Your early coordination is appreciated. If you have any questions regarding this response, please contact Mr. Kent Kroonemeyer, Supervisor, Fish and Wildlife Service, 1215 East Highway 30, Grand Island, Nebraska, (FTS 864-2225).

Sincerely,

Gilbert E. Key

Gilbert E. Key
Acting Area Manager

cc: ENV, Region 6, Denver, CO
ENV, Grand Island, NE
SE, Washington, D.C.

APPENDIX B

EPA DRINKING WATER STANDARDS

GROUND WATER REQUIREMENTS

Water Treatment Requirements*

1. General Requirements

The water quality requirements of the EPA Drinking Water Standards are minimum requirements, and good quality water should have physical and chemical characteristics considerably better than the limiting values established in the EPA Drinking Water Standards (Sections 4.2, 5.1, 5.2, 6.1, and 6.2). For example, water with turbidity of 5 units and a color of 15 units may be acceptable, but in a coagulated, filtered water such values could indicate serious malfunctioning of the purification process. (The EPA Drinking Water Standards are being revised currently, and will contain a recommendation that the turbidity standard be reduced to 1 turbidity unit. This and other revisions of the Drinking Water Standards, proposed at the time of this printing, are shown on the following pages.) Similarly, increased concentrations of copper and iron could indicate a corrosiveness that would be objectionable to consumers, even though the concentrations of the metals did not exceed recommended limits. In well water an increase in chlorides over the normal amount found in ground waters in the area may be the first indication of pollution.

The type of treatment required depends on the characteristics of the watershed, the raw water quality, and the desired finished water quality. If pollution of the source water is increasing, plant facilities, which were adequate for treatment of a nonpolluted water, may become inadequate. The production of water that is free from pathogenic organisms, aesthetically satisfactory to the senses, and reasonably acceptable chemically becomes increasingly difficult when the raw water has a high and varying chlorine demand, contains large numbers of coliform bacteria, or contains high concentrations of dissolved solids, toxic substances, or taste and odor producing substances.

When evaluating the ability of a water supply system to constantly produce a safe and satisfactory water, these factors should be considered:

(a) the quality of water produced at times of unusual stress, such as during heavy run-offs, periods of drought, or periods of excessive demand as shown in the records;

(b) the quality of the raw and finished waters, as determined by laboratory data and sanitary surveys, and any trends in improvement or deterioration;

(c) the purification processes, including the facilities used to apply disinfectants at various locations in the treatment process, and their capacities compared with the capacities considered necessary to meet maximum anticipated requirements;

(d) the treatment processes used and their reliability in changing raw water characteristics to produce a finished water that continuously meets the PHS Drinking Water Standards;

(e) the minimum residual chlorine concentration in the plant effluent water, when chlorine is used, together with the time that this or greater chlorine levels were maintained;

(f) the qualifications of the operators and laboratory personnel, as indicated by appropriate training, or certification, or both; and

*"Manual For Evaluating Public Drinking Water Supplies" U.S. Environmental Protection Agency, 1971, pp. 4-12; updated with Proposed Primary Drinking Water Regulations, June 1975.

2. Extent of Treatment

The Public Health Service recommends that all municipal water supplies, whether they be ground water or surface water, receive treatment by disinfection regardless of the quality of the water. The benefits from the added protection provided by disinfection far outweigh the increased cost and the added maintenance incurred by the water utility. When coliform density is used as one criterion for judging treatment requirements, raw waters can be divided into three groups: clean, clear, and polluted waters. The coliform densities of the raw waters can be expressed in terms of the most probable number (MPN) from the multiple-tube fermentation technique, or actual coliform counts determined by the membrane filter (MF) technique.

The requirements are given for three groups of water: those usable without treatment, those needing disinfection only, and those needing complete treatment. The quality requirements listed below are the proposed EPA primary drinking water standards*, that are proposed as revisions to the current PHS Drinking Water Standards. They differ from the current PHS Standards in that some standards have been added, some have been deleted, and others modified.**

A. Bacteriological Quality: The coliform standard remains the same as the PHS Drinking Water Standards, 1962, plus the inclusion of a standard plate count limit of 500 organisms per ml.

Turbidity

1 turbidity unit
(up to 5 TU may be allowed in some cases)

****The EPA is also considering secondary drinking water regulations pertaining to color, taste and odor, chloride, copper, foaming agents, iron, manganese, sulfate and zinc. Ground water requirements for land application systems should consider these parameters in terms of aesthetic acceptability of existing and potential drinking water supplies and the cost-effectiveness of control by standard water treatment practice.**

C. *Chemical Quality*: chemical concentrations should not exceed the following:

<u>Substance</u>	<u>Maximum Allowable Limits concentration mg/liter</u>
Arsenic (As)	0.05
Barium (Ba)	1
Cadmium (Cd)	0.010
Chromium (Cr)	0.05
Cyanide (CN)	0.2
Flouride (F) ^a	
up to 53.7°F	2.4
53.8-58.3	2.2
58.4-63.8	2.0
63.9-70.6	1.8
70.7-79.2	1.6
79.3-90.5	1.4
Lead (Pb)	0.05
Mercury (Hg)	0.002
Nitrate Nitrogen	10
Organics-Carbon Absorbable	.
CCE	0.7
Selenium (Se)	0.01
Silver (Ag)	0.05

Annual average of maximum daily air temperature.

Substances not included in the above table that may have deleterious physiological effect or that may be excessively corrosive to the water supply system should not be permitted in the raw water supply.

D. *Radioactivity*: should comply with the following limits:

RADIUM 226, RADIUM 228, and GROSS ALPHA PARTICLE RADIOACTIVITY

Combined Radium 226 and Radium 228 - 5pCi/l

Gross Alpha Particle Activity - 15pCi/l

BETA PARTICLE and PHOTON RADICACTIVITY from MAN-MADE RADIONUCLIDES

The average annual concentration of beta particle and photon radioactivity from man-made radionuclides shall not produce an annual dose equivalent to the total body or any internal organ greater than 4 millirem, assuming a 2 liter per day drinking water intake.

E. *Pesticides*: should not exceed the following limits:

<u>Pesticide</u>	<u>Maximum permissible concentration, mg/l</u>
Chlordane	0.003
Endrin	0.0002
Heptachlor	0.0001
Heptachlor epoxide	0.0001
Lindane	0.004
Methoxychlor	0.1
Toxaphene	0.005
2, 4-D	0.1
2, 4, 5-TP	0.01

Group II. Requirements for Water Needing Disinfection Only

A. *Physical, Chemical, Radioactivity, and Pesticide Requirements*: the requirements as shown for untreated raw ground water (Groups I.B, I.C, I.D, and I.E) should be met. If the water does not consistently meet all these requirements, consideration should be given to providing additional treatment during periodic decreases in quality that result from high turbidity, tastes, etc.

B. *Bacteriological Quality*:

1. *Fecal Coliform Density*: If fecal coliform density is measured, the total coliform density discussed below may be exceeded, but fecal coliform density should not, in any case, exceed 20 per 100 milliliters as measured by a monthly arithmetic mean. When the fecal coliform vs. total coliform criterion is used for Group II water, the fecal coliform count should never exceed the 20 per 100 milliliters monthly arithmetic mean. This fecal coliform standard only applies when it is being measured on a regular basis.
2. *Total Coliform Density*: Less than 100 per 100 milliliters as measured by a monthly arithmetic mean.

Group III. Requirements for Water Needing Treatment by Complete Conventional Means Including Coagulation, Sedimentation, Rapid Granular Filtration, and Disinfection (Pre and Post)

C. *Bacteriological Quality*:

1. *Fecal Coliform Density*: If fecal coliform density is measured, the total coliform density discussed below may be exceeded, but fecal coliform should not exceed 2.000 per 100 milliliters as measured by a monthly geometric mean.

2. **Total Coliform Density:** Less than 20,000 per 100 milliliters as measured by a monthly geometric mean.

The same rationale applies here as in the Group II waters concerning the use of the fecal coliform vs. total coliform criterion. In no case should the fecal coliform count exceed the 2,000 per 100 milliliters monthly geometric mean.

The arithmetic mean is used with the Group II waters because the bacteriological data from these waters will be of lesser magnitude than that from the Group III waters; this difference in magnitude between the monthly means of the Group II and Group III waters is best reflected by the arithmetic and geometric means, respectively.

These bacteriological limits may possibly be exceeded if treatment (in addition to coagulation, sedimentation, rapid granular filtration, and disinfection) is provided and is shown to be doing a satisfactory job of providing health protection.

- B. Physical Quality:** Elements of color, odor, and turbidity contribute significantly to the treatability and potability of the water.

1. **Color:** A limit of 75 color units should not be exceeded. This limit applies only to nonindustrial sources; industrial concentrations of color should be handled on a case-by-case basis and should not exceed levels that are treatable by complete conventional means.

2. **Odor:** A limit of 5 threshold numbers should not be exceeded.

3. **Turbidity:** The limits for turbidity are variable. Factors of nature, size, and electrical charge for the different particles causing turbidity require a variable limit. Turbidity should remain within a range that is readily treatable by complete conventional means. It should not overload the water treatment works, and it should not change rapidly either in nature or in concentration when such rapid shifts would upset normal treatment operations.

- C. Chemical Quality:** Since there is little reduction in chemical constituents with complete conventional treatment, raw water should meet the limits given for Group I.C.

- D. Radioactivity:** Should comply with Certification Limits given in Group I.D.

- E. Pesticides:** Should comply with requirements for pesticides as shown for untreated raw ground water in Group I.E.

Infectious material, the increasing diversity of chemical pollutants found in Group III raw waters, and the many different situations encountered in regional and local problems make it impractical to prescribe a limited selection of facilities and processes that can effectively handle all problems presented by raw water and its sources. Future improvements in treatment technology cannot be reasonably assisted or regulated by requiring the fixed process steps considered good for today's technology. Table 1 describes some factors that increase the difficulty in securing disinfection, e.g., adequate disinfection with halogens depends on temperature, pH, contact time, and concentration of disinfectant.

Types of disinfection other than chlorination must be demonstrated to function effectively in all compositions of water likely to be encountered from the source used. If a distribution system is of any considerable length, the disinfection method should provide a residual protection that can be easily measured.

Table 1. CONDITIONS CREATING DIFFICULTIES AT THE WATER PLANT AND IN THE WATER MAINS		
Bacterial and biological conditions	Chemical conditions	Physical and operational conditions
Increasing numbers of coliforms	Ammonia nitrogen	Low temperature
Biological pollution, i.e., algal or fungal metabolic products that effect chlorine demand	Toxic materials or taste and odor requiring removal	Extended distribution sys- tems
Filter clogging organisms that effect chlorine demand	Color or organic dispersing agents (anticoagulants), ligni compounds	Highly variable water quality
	Chlorine demand	Rapid variation in flow and turbidity of surface water resource
	Iron and manganese	Tidal effects
	High organic content	
	High or organic content	
	High or fluctuating pH	

Where water sources show continuing quality deterioration or the quality of water available is not adequate for future demand, the water purveyor should be examining alternate or auxiliary sources of supply and should have positive plans to procure adequate facilities and sources.

APPENDIX C

NON-MUNICIPAL POLLUTION SOURCES

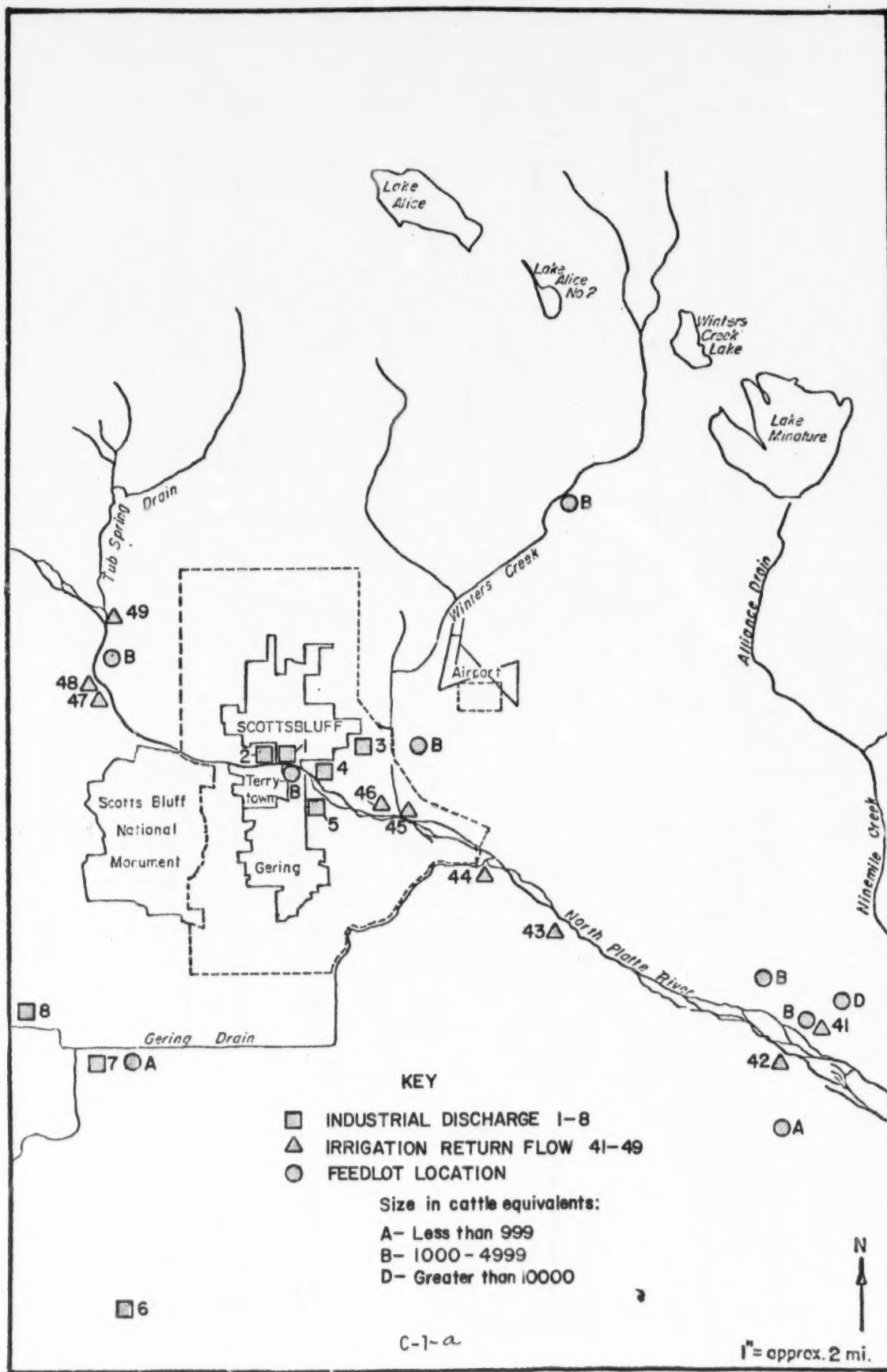


Table C-1

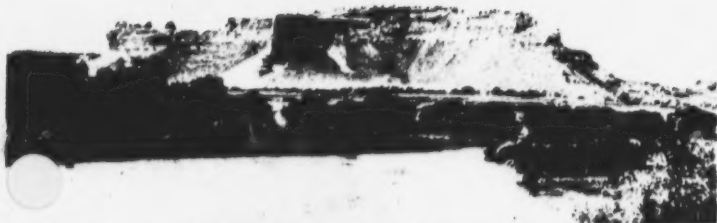
Industrial Wastewater Discharges in the Study Area						
Map #	Firm	Location	Wastewater	Flow(MGD)	Wastewater Treatment Facility	Discharge Point
1	NPPD Bluffs Power Plant	Scottsbluff	Cooling Water	25.0	Cooling tower, recirculation	N. Platte River
2	CRA Inc.	Scottsbluff	1. Oil refinery wastes 2. Cooling water	0.17 2.96	1. Lagoons 2. Oil separator	1. Ditch to N. Platte R. 2. Storm sewer to N. Platte R. Scottsbluff Drain
3	Flannery Foods	Scottsbluff	1. Cooling water	0.384	None	
4	Great Western Sugar Co. 2	Scottsbluff	1. Condenser water & ash pond overflow 2. General plant wastes	6.2 Not known	Ash pond Vibrating screens, clarifier, surge pond, complete retention mud pond Complete retention lagoon	1. N. Platte River 2. -- 3. --
5	Great Western Sugar Co. 2	Gering	1. Condenser water & ash pond overflow 2. General plant wastes	5.5 Not known	Ash pond Vibrating screens, clarifier, surge pond, complete retention mud pond Complete retention lagoon	1. N. Platte River 2. -- 3. --
6	Atlantic Richfield Co., Canal Field Facility	Gering	1. Brine pumped with crude petroleum	0.018		
7	Gary Operating Co., Hanlon Lease	Gering	1. Brine pumped with crude petroleum	0.004	Physical separators, chemicals flotation, evaporation	Tributary to Gering Drain
8	Gary Operating Co., Koch Lease	Gering	1. Brine pumped with crude petroleum	0.006	Physical separators, chemicals flotation, evaporation	Tributary to Gering Drain

Table C-2
Irrigation Return Flow in the Study Area

<u>Map #</u>	<u>Description</u>	<u>Flow (cfs)</u>
41	Fairfield Seep	3.01
42	Melbeta Drain	6.55
43	Central Canal	Not Known
44	Gering Drain	95.00
45	Winters Creek	88.5
46	Scottsbluff Drain	5.2
47	Mitchell-Gering Canal	Not Known
48	Mitchell-Gering Canal	Not Known
49	Tub Springs Creek	40.3

APPENDIX D

COMMENTS ON USE OF BRIDGE



SCOTTS BLUFF NATIONAL MONUMENT LOCATED IN AMERICA'S VALLEY OF THE NILE

Scotts Bluff County
Highway and Bridge Dept.

~~XXXXXXXXXXXXXXXXXXXXXXXXXXXX~~

Phone 632-5331

1001 Ave. I

Scottsbluff, Nebraska 69361

P.O. Box 799

July 15, 1977

United States Environmental
Protection Agency
Region VII
1735 Baltimore
Kansas City, Missouri 64108

Attn: Charles V. Wright

Dear Mr. Wright:

In regard to your letter of July 8, 1977, Scotts Bluff County would have no objections to multiple use of the land rights and bridge crossing for the waste water force main under the following conditions:

1. The attachment of the force main would require a structure analysis, the cost of which should not be borne by Scotts Bluff County.
2. The final bridge plans have been approved by the Federal Highway Administration. Any structural changes must be approved by both the State of Nebraska, and the Federal Highway Administration, which might delay construction of our project. As this project is sorely needed, we would object to any delay of the anticipated April, 1978 bid letting.
3. The custodian of said force main must assume all liabilities for damages, both present and future, arising from said force main installation.

We are always glad to cooperate in any project which is beneficial for public good and environmental protection. We would appreciate information as EIS progresses on the force main project.

Very truly yours,

SCOTTS BLUFF COUNTY

C.A. Thomas
Chairman

RAM/jt

cc: Raymond H. Hogrefe
Federal Highway Admin.
1701 South 17th St.
Lincoln

State of Nebraska

J. JAMES EXON, GOVERNOR

DEPARTMENT OF ROADS
DIRECTOR-STATE ENGINEER
DAVID O. COOLIDGE

P. O. BOX 94759
LINCOLN, NEBR. 68509
402-477-6012



July 18, 1977

Mr. Charles V. Wright
Acting Regional Administrator
United States Environmental Protection Agency
1735 Baltimore
Kansas City, Missouri 64108

Dear Mr. Wright:

I am replying to your letter of July 11, 1977 which was addressed to the Director-State Engineer.

Before we can make any commitment regarding the possibility of attaching a waste water force main to the new proposed relocated Highway 71, the existing Highway 71 or the proposed FAS-28 County bridges we would need to know the size of the main and its loaded weight per foot.

The most difficult would probably be an attachment to the existing Highway 71 bridge. The plans for the other two bridges are complete and approved by the Federal Highway Administration and both will probably be let to contract within the next year. This would require rather prompt action on your part to get the plans changed and approved to include any attachments. An attachment to the County bridge would of course need to be approved by the County.

Also, the State would need to be reimbursed by the owner of the main for any expense caused the State for redesign of the bridge and for additional bridge materials that may be necessary due to the attachment.

In addition any formal request to place sewer lines within the highway rights of way and on bridges shall be accompanied by a notarized statement, advising the Department of Roads that the proposed sewer meets with all State and Federal laws, and all licenses, permits or approval have been acquired from the agency charged with the responsibility for enforcing the Federal Water Pollution Control Act of 1972.

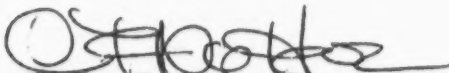
Charles Wright
Page 2

July 18, 1977

If you wish to pursue this any further, I would suggest you contact our Bridge Division, Mr. Jim Holmes, Bridge Engineer for more specifics regarding the design of the bridges concerned. His address is the same as in your original correspondence or telephone 402-473-4701.

Yours very truly,

DEPARTMENT OF ROADS



Charles F. Nutter
Deputy State Engineer
for Engineering Services

APPENDIX E

WIND ROSE

ANNUAL RELATIVE FREQUENCY DISTRIBUTION STATION #24020 SCOTTS BLUFF NEAR 8

SPEED(KTS)

DIRECTION	0 - 3	4 - 6	7 - 10	11 - 16	17 - 21	GREATER THAN 21	TOTAL
N	0.008418	0.023219	0.020274	0.017055	0.005548	0.001370	0.075883
NNE	0.004899	0.012808	0.010479	0.007260	0.001027	0.000548	0.037022
NE	0.006040	0.014658	0.010685	0.006781	0.002123	0.000274	0.040561
ENE	0.003223	0.012123	0.010548	0.007740	0.001027	0.000205	0.034867
E	0.009529	0.032260	0.038238	0.012329	0.000274	0.000068	0.092748
ESE	0.006751	0.027877	0.051986	0.031438	0.004452	0.000137	0.122641
SE	0.004640	0.015822	0.027192	0.024178	0.004521	0.000274	0.076626
SSE	0.003030	0.009247	0.011712	0.011027	0.001781	0.000068	0.036866
S	0.003939	0.011644	0.011370	0.007671	0.001096	0.000274	0.035993
SSW	0.001681	0.003356	0.004041	0.001986	0.000274	0.000137	0.011475
SW	0.002011	0.004521	0.002534	0.001507	0.000137	0.000000	0.010710
WSW	0.001996	0.007055	0.004041	0.001849	0.000753	0.000205	0.015900
W	0.005686	0.016507	0.022808	0.022123	0.011233	0.005274	0.083631
WNW	0.007627	0.027945	0.044041	0.037740	0.014110	0.006233	0.137695
NW	0.007541	0.024726	0.034726	0.025685	0.011644	0.005137	0.109458
NNW	0.007374	0.019384	0.020068	0.016712	0.009932	0.004452	0.077922
TOTAL	0.084383	0.263150	0.324794	0.233082	0.069932	0.024658	
TOTAL RELATIVE FREQUENCY OF OBSERVATIONS	= 1.000001						
TOTAL RELATIVE FREQUENCY OF CALMS DISTRIBUTED ABOVE	= 0.045068						

SEA = DJF RELATIVE FREQUENCY DISTRIBUTION STATION = 24028 SCOTTS BLUFF NEBR 8 OBS

DIRECTION	SPEED(KTS)						TOTAL
	0 - 3	4 - 6	7 - 10	11 - 16	17 - 21	GREATER THAN 21	
N	0.008070	0.026944	0.021667	0.017778	0.003333	0.000833	0.078626
NNE	0.003654	0.008333	0.008611	0.003889	0.000556	0.000000	0.025043
NE	0.003866	0.012222	0.006944	0.003056	0.002500	0.000000	0.028588
ENE	0.002453	0.011111	0.007778	0.006944	0.001389	0.000278	0.029953
E	0.007529	0.025278	0.031389	0.012222	0.000000	0.000000	0.076418
ESE	0.004784	0.016667	0.039167	0.041111	0.010556	0.000000	0.112284
SE	0.001596	0.009444	0.020000	0.015278	0.002222	0.000000	0.048541
SSE	0.001850	0.006667	0.005556	0.005556	0.000278	0.000000	0.019906
S	0.003023	0.008333	0.005833	0.003611	0.000000	0.000000	0.020801
SSW	0.001323	0.002778	0.002222	0.000833	0.000000	0.000000	0.007156
SW	0.001638	0.002778	0.001389	0.001111	0.000278	0.000000	0.007194
WSW	0.003315	0.005833	0.004167	0.001667	0.001389	0.000000	0.016370
W	0.005655	0.016111	0.024444	0.032500	0.022500	0.013056	0.114266
WNW	0.006771	0.026667	0.057500	0.058056	0.028333	0.012222	0.189548
NW	0.008598	0.030833	0.039444	0.035000	0.013056	0.006111	0.133042
NNW	0.007265	0.023333	0.026111	0.019444	0.013056	0.003056	0.092265
TOTAL	0.071389	0.233333	0.302222	0.258055	0.099444	0.035556	

TOTAL RELATIVE FREQUENCY OF OBSERVATIONS = 1.000001

TOTAL RELATIVE FREQUENCY OF CALMS DISTRIBUTED ABOVE = 0.036389

SEA= NAM RELATIVE FREQUENCY DISTRIBUTION STATION =24028 SCOTISBLUFF NEBR 8 OR

SPEED(KTS)

DIRECTION	0 - 3	4 - 6	7 - 10	11 - 16	17 - 21	GREATER THAN 21	TOTAL
N	0.005803	0.016576	0.022011	0.024457	0.009783	0.002989	0.081618
NNE	0.004439	0.011413	0.010870	0.009783	0.001630	0.002174	0.040309
NE	0.005258	0.014946	0.013043	0.009783	0.002174	0.000815	0.046019
ENE	0.001405	0.007609	0.010598	0.013587	0.001359	0.000272	0.034829
E	0.005811	0.025272	0.033152	0.016304	0.001087	0.000272	0.081898
ESE	0.004056	0.017391	0.046739	0.036957	0.004620	0.000272	0.110034
SE	0.004363	0.013043	0.023641	0.035326	0.009239	0.000815	0.086428
SSE	0.002998	0.007880	0.009239	0.013859	0.002717	0.000272	0.036966
S	0.003505	0.009239	0.007337	0.007337	0.002174	0.000815	0.030407
SSW	0.000817	0.001359	0.004348	0.002989	0.000272	0.000000	0.009784
SW	0.001712	0.003261	0.002446	0.001087	0.000272	0.000000	0.008778
WSW	0.001093	0.005435	0.003261	0.002174	0.000815	0.000272	0.013049
W	0.004054	0.015217	0.023098	0.024457	0.010870	0.004620	0.082315
WNW	0.006900	0.026359	0.043207	0.039674	0.012772	0.006522	0.135432
NW	0.007088	0.019022	0.033424	0.030435	0.021467	0.009511	0.120946
NNW	0.005373	0.013587	0.017663	0.019837	0.015761	0.008967	0.081188
TOTAL	0.064674	0.207608	0.304076	0.288043	0.097011	0.038587	

TOTAL RELATIVE FREQUENCY OF OBSERVATIONS = 1.000001

TOTAL RELATIVE FREQUENCY OF CALMS DISTRIBUTED ABOVE = 0.034239

SEA = JJA

RELATIVE FREQUENCY DISTRIBUTION

STATION = 24028 SCOTTSBLUFF NEBR 8 OBS

SPEED(KTS)

DIRECTION	0 - 3	4 - 6	7 - 10	11 - 16	17 - 21	GREATER THAN 21	TOTAL
N	0.006349	0.019565	0.014402	0.011685	0.003804	0.000543	0.056349
NNE	0.007171	0.016848	0.014130	0.007609	0.001630	0.000000	0.047388
NE	0.008119	0.016848	0.011685	0.008424	0.002446	0.000272	0.047793
ENE	0.005180	0.018207	0.016304	0.007609	0.000815	0.000272	0.048386
E	0.014033	0.045380	0.055978	0.014130	0.000000	0.000000	0.129523
ESE	0.012391	0.050815	0.072011	0.026359	0.002446	0.000272	0.164293
SE	0.007640	0.025543	0.041576	0.031522	0.002717	0.000272	0.109270
SSE	0.003889	0.012228	0.019022	0.017391	0.002717	0.000000	0.055248
S	0.004238	0.016304	0.020109	0.011141	0.001359	0.000000	0.053151
SSW	0.003098	0.005435	0.006250	0.002174	0.000272	0.000543	0.017772
SW	0.002599	0.006250	0.003804	0.002446	0.000000	0.000000	0.015099
WSW	0.001645	0.008152	0.004620	0.001902	0.000543	0.000000	0.016862
W	0.007336	0.021739	0.020109	0.007337	0.002446	0.001087	0.060053
WNW	0.008000	0.025815	0.024728	0.014946	0.003533	0.001087	0.078109
NW	0.005983	0.021196	0.019293	0.009511	0.001630	0.000815	0.058429
NNW	0.006949	0.015489	0.010326	0.008152	0.001359	0.000000	0.042275
TOTAL	0.104619	0.325815	0.354347	0.182337	0.027717	0.005163	
TOTAL RELATIVE FREQUENCY OF OBSERVATIONS =	1.000001						
TOTAL RELATIVE FREQUENCY OF CALMS DISTRIBUTED ABOVE =	0.060326						

SEA = SON RELATIVE FREQUENCY DISTRIBUTION STATION = 24020 SCOTTS BLUFF NEAR 0 D

SPEED (KTS)

DIRECTION	0 - 3	4 - 6	7 - 10	11 - 16	17 - 21	GREATER THAN 21	TOTAL
N	0.013251	0.029945	0.023077	0.014286	0.005220	0.001099	0.086877
NNE	0.004358	0.014560	0.008242	0.007692	0.000275	0.000000	0.035127
NE	0.006880	0.014560	0.010989	0.005769	0.001374	0.000000	0.039572
ENE	0.003911	0.011538	0.007418	0.002747	0.000549	0.000000	0.026164
E	0.010860	0.032967	0.032418	0.006593	0.000000	0.000000	0.082838
ESE	0.006102	0.026374	0.049725	0.021429	0.000275	0.000000	0.103904
SE	0.005069	0.015110	0.023352	0.014286	0.003846	0.000000	0.061663
SSE	0.003393	0.010165	0.012912	0.007143	0.001374	0.000000	0.034986
S	0.005019	0.012637	0.012088	0.008516	0.000824	0.000275	0.039360
SSW	0.001514	0.003846	0.003297	0.001923	0.000549	0.000000	0.011129
SW	0.002113	0.005769	0.002473	0.001374	0.000000	0.000000	0.011729
WSW	0.001929	0.008791	0.004121	0.001648	0.000275	0.000549	0.017314
W	0.005691	0.012912	0.023626	0.024451	0.009341	0.002473	0.078493
WNW	0.008652	0.032967	0.051099	0.038736	0.012088	0.005220	0.148762
NW	0.008237	0.028022	0.046978	0.028022	0.010440	0.004121	0.125820
NNW	0.009724	0.025275	0.026374	0.019505	0.009615	0.005769	0.086262
TOTAL	0.096703	0.295439	0.338187	0.204121	0.056044	0.019505	

TOTAL RELATIVE FREQUENCY OF OBSERVATIONS = 1.000001

TOTAL RELATIVE FREQUENCY OF CALMS DISTRIBUTED ABOVE = 0.049176

APPENDIX F

SOILS SUITABILITY FOR AGRICULTURAL IRRIGATION AND SITE SOILS

CRITERIA FOR SELECTION OF SUITABLE SOIL TYPES FOR IRRIGATION SITES

Four site criteria to be used in the land treatment of effluents are defined in this section. The order in which the criteria are discussed does not imply their relative importance. The failure of a site to satisfy any one criterion or a combination of criteria may exclude it from consideration as an area potentially suitable for land application. Conversely, sites that satisfy most or all of the criteria listed can be considered to be suitable as locations for irrigation facilities, at least insofar as the first approximation is concerned.

1. Seasonally High Water Table

The minimum depth to the seasonally high water table should be 5 feet (Reed et al., 1972; Pound et al., 1973; Sullivan et al., 1973; US-EPA 1975b). Unsaturated soil to a depth of at least 5 feet is required to assure that there will be an aerobic zone for plant roots. This also is the minimum thickness considered necessary to protect the quality of the groundwater. Greater soil thickness would be required if soil is excessively permeable.

Areas in which the depth to the seasonally high water table is 5 feet or more, and in which the average depth to the water table exceeds 10 feet, are considered to be most suitable locations for land treatment facilities.

2. Soil Permeability

The soil must be sufficiently permeable to accept water at the designated rate of daily application and to prohibit ponding of water on the surface for any extended period. The rate of permeability also must be sufficient to allow an adequate time for the water to be renovated by biological, chemical, and physical processes as it moves through the soil profile. The permeability of the soil must, therefore, be in the range of 0.1 inch per hour to 10.0 inches per hour throughout the profile (Parizek, 1974). The minimum acceptable daily rate of infiltration from surface application is 2 inches per day (Pound et al., 1973; US-EPA, 1975a). A percolation rate of 4 to 15 minutes per inch, determined by conventional short-term field percolation tests, indicates a potentially useful site.

Conventional field percolation tests, however, generally are considered to be inadequate for evaluations of the long-term suitability of areas for land treatment (Reed et al., 1972).

No correlation can be made with confidence between coefficients of permeability and coefficients of infiltration or percolation (Telephone communications, 12 March 1975, Wendall Kirkam and Dale Snyder, US Soil Conservation Service). Permeability coefficients are determined from a vertical core of soil in the laboratory and are measures of the rate at which water moves downward, as well as the rate of the horizontal movement of water. These tests normally are made by digging a pit to a depth at which layers with low permeability may be penetrated.

3. Soil Texture

Soils that contain a large proportion of clay-size and silt-size particles and organic matter and, therefore, have a high cation-anion exchange capacity, are desired for wastewater renovation. Soils should be in the loam range, but most soils in the range from clays to sands are acceptable (Pennsylvania Bureau of Water Quality Management, 1972; Pound et al., 1973). Silt loam and sandy loam, particularly those with a clay content of 15 to 30 percent are preferable (Reed et al., 1972; Sullivan et al., 1973; US-EPA, 1974). These textures should extend throughout the soil profile.

4. Slope

The degree of slope (i.e., measured in percent, or the vertical difference in feet per 100 feet of horizontal distance) that is acceptable varies with the nature of the plant cover. In the following tabular summary, slope limits established for the Great Lakes Region (Anon, 1971) and Pennsylvania (Pennsylvania Bureau of Water Quality Management, 1972) are listed in column A; limits cited by Pound and Crites (1973) and by the US-EPA (1974) are listed in column B.

	<u>A</u>	<u>B</u>
Cultivated crops	to 4%	to 10(15)%
Sod farms	to 8%	
Forests	to 8(14)%	to 30%

Slope limitations are set primarily for the minimization of potential soil erosion. Subsurface lateral flow of water, however, generally is more rapid, and is a larger component of subsurface water transport on steep slopes than on more gentle slopes. For cultivated crops, the slope limitations also take into account the logistics of farm equipment operation. Densely forested sites, with well-developed forest floors, are acceptable on slopes that may range to 30 percent. The Great Lakes Basin Commission, the Upper Mississippi River Conservation Commission, and the State of Pennsylvania limit forested sites that are used throughout the year to slopes not exceeding 8 percent, but consider seasonally-used sites on slopes as great as 14 percent. Because several of the soil series are susceptible to rapid erosion at relatively low slope angles, slopes should be no more than 5 percent in the Scottsbluff study area.

LOCAL SOILS SUITABLE FOR SPRAY IRRIGATION

Soils listed below possess an average water table depth greater than 10 feet, permeability between 0.1 and 10 inches per hour, soil texture composed of 15 to 30 percent clay, slopes of less than 5 percent, and a moderately deep to deep soil profile:

<u>Soil Series</u>	<u>Mab Symbols</u>
Alice	AcA, AcB, AeA
Bridgeport	BuA, BuB
Buffington	Bg, BgA, 2Bg
Keith	KuB2

Locations within the study area where these soil series occur should be

considered highly suitable for land application of wastewater effluents.

Other area soils may have limited suitability for land application, or possess restrictive characteristics which should be further investigated and assessed. These soils should not, however, be excluded as potential areas for the disposal of wastewater unless site-specific data are acquired confirming this fact. These soils include:

<u>Soil Series and Symbols</u>	<u>Remarks</u>
Anselmo (AnA, AnB)	Local alkali soils restrict permeability
Bayard (BfA, BfB)	High permeability
Creighton (COB)	Moderate permeability
Dunday (DVA, DVB)	Very low clay content; high permeability and rapid water uptake
Duroc (Dr)	Subject to flooding
Keith (KE, KeA, KeB)	Can be shallow
Mitchell Mt. (MtA, MtB MzA, MzB)	Low clay content; moderate permeability
Otero (OBA, OBB, OC, OtB, OdB)	Moderately high permeability
Santanta (Sa)	Locally shallow; moderately high permeability
Tripp (TrA, Tv, TvA TvB2)	Moderately low clay content; moderately high permeability

DISTRIBUTION OF SUITABLE SOILS

Suitable and nearly suitable soil series are members of four soil associations. The distribution of these associations is shown in Figure D-1. These four associations occupy about 60 percent of the land area of Scotts Bluff County. Although it is evident that not all of the soil series that are included in these associations or the areas occupied by the soil series identified in the previous section will be suitable areas, it nonetheless is clear that several sites that meet all other criteria could be identified upon more careful examination of the study area.

1. Bayard-Bridgeport Association

This association comprises deep, sandy and loamy soils on foot slopes of the Wildcat Hills and in a broader belt bordering the uplands in the northeastern part of the county (Figure D-2). A few scattered areas occur elsewhere. The Bridgeport series has no restrictions; the Bayard contains areas of high permeability. This section covers about 15 percent of the county.

2. Mitchell-Keith-Epping Association

This association comprises deep and shallow, loamy and sandy soils on uplands distributed throughout the county, and in the west and southwestern parts (Figure D-3). A narrow area borders the Mitchell Bottom and Gering Valley, a fairly large area is south of Lake Alice, and a smaller area is southeast of Lake Minatare.

The Epping series is considered to be unsuitable for spray irrigation. The Mitchell series contains a low clay content and displays moderate permeability. The Keith series can be shallow locally. This association covers about 18 percent of the county.

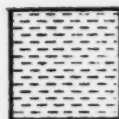
3. Trip-Alice-Dunday Association

This association comprises deep, loamy and sand soils on high benches and terraces north of the North Platte River (Figure D-4). The Alice series has no restrictions. The Dunday series has a very low clay content and a high permeability and rate of water uptake. The Tripp series has a moderately low clay content. This association covers about 15 percent of the county (Yost et al., 1968).

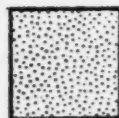
F-1. General



Figure F-1 (cont'd) Key to the General Soil Map of the
Scottsbluff Study Area



Tripp-Alice-Dunday association: Deep,
loamy and sandy soils on high benches
and terraces



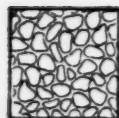
Gravelly land-Dix-Chappell association:
Shallow to deep, gravelly soils on breaks
of terraces



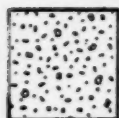
Las-Alluvial land-McCook association:
Loamy, sandy, and gravelly soils on
bottom lands



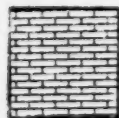
Bayard-Bridgeport association: Deep,
sandy and loamy soils on foot slopes



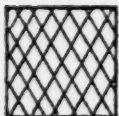
Valentine-Dwyer association: Deep,
sandy soils on uplands



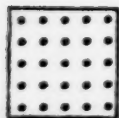
Minatare-Janise association: Strongly
saline-alkali soils on bottom lands



Mitchell-Otero-Buffington association:
Deep, silty, sandy, and clayey soils on
valley floors



Tassel-Anselmo-Rock outcrop association:
Shallow and deep, sandy soils and outcrops
of rock on uplands



Mitchell-Keith-Epping association:
Deep and shallow, loamy and sandy
soils on uplands

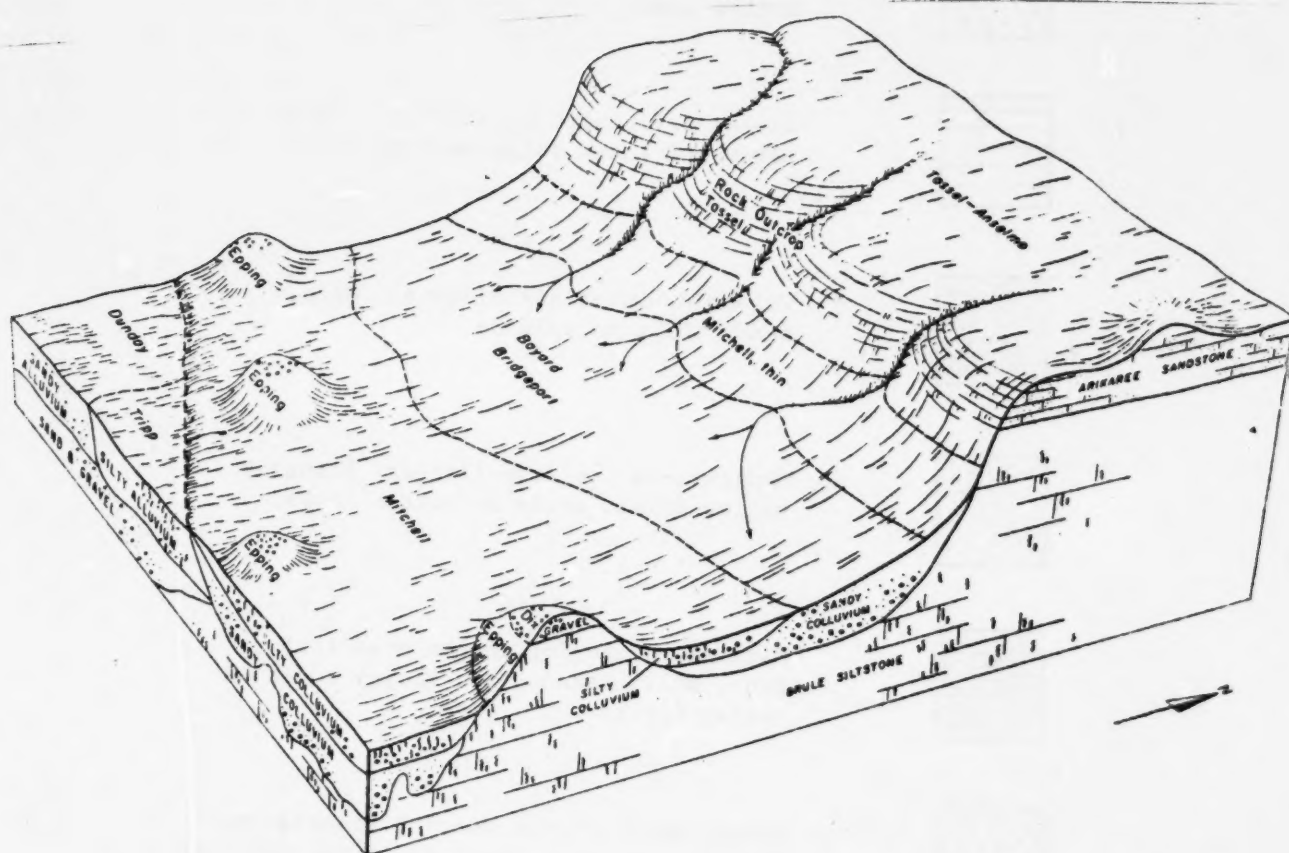


Figure F-2

Major Soils and Underlying Material of the Bayard-Bridgeport
and Mitchel-Keith-Epping Associations

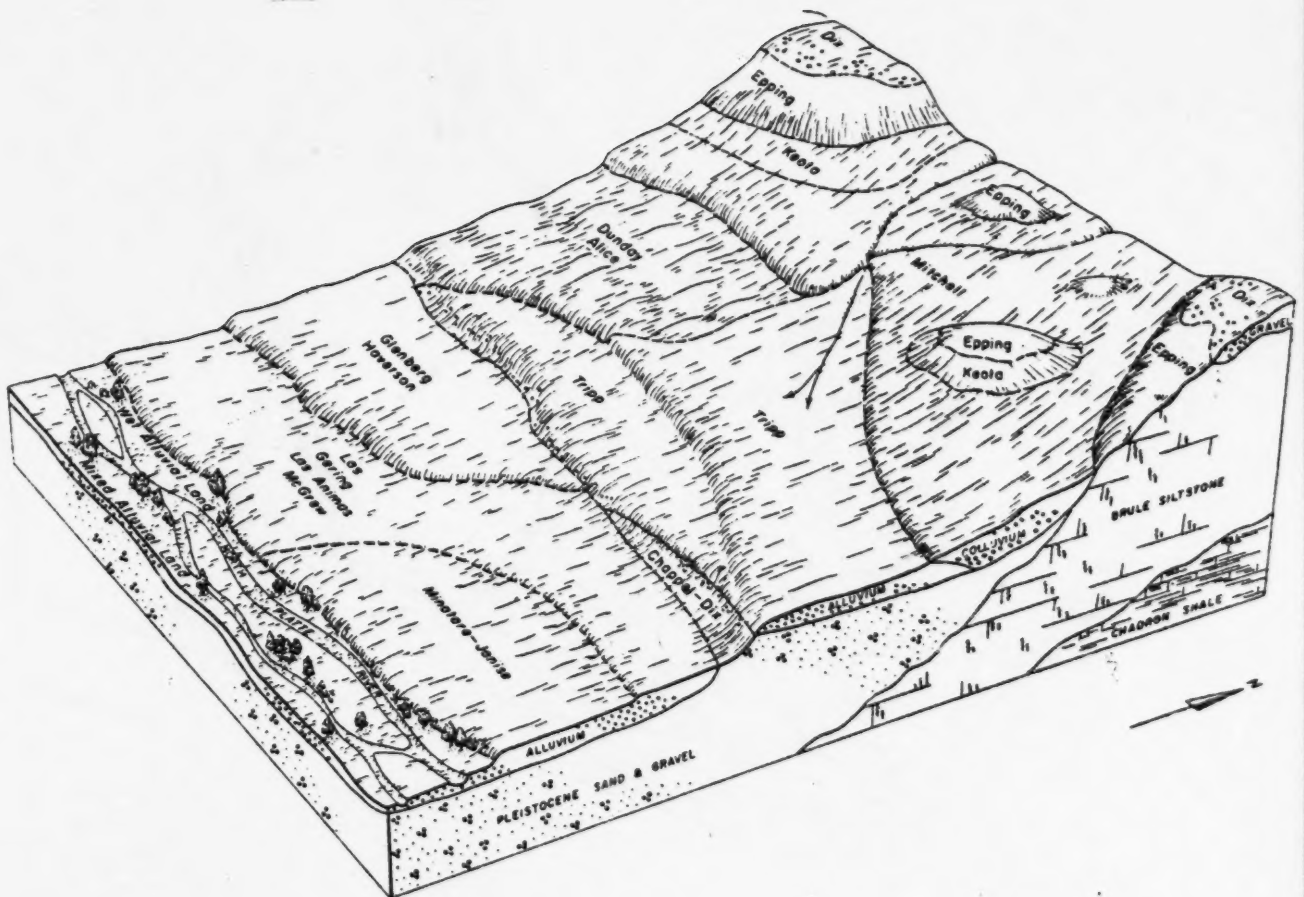


Figure F-3

Major Soil Series and Underlying Material of the
Tripp-Alice-Dunday Association

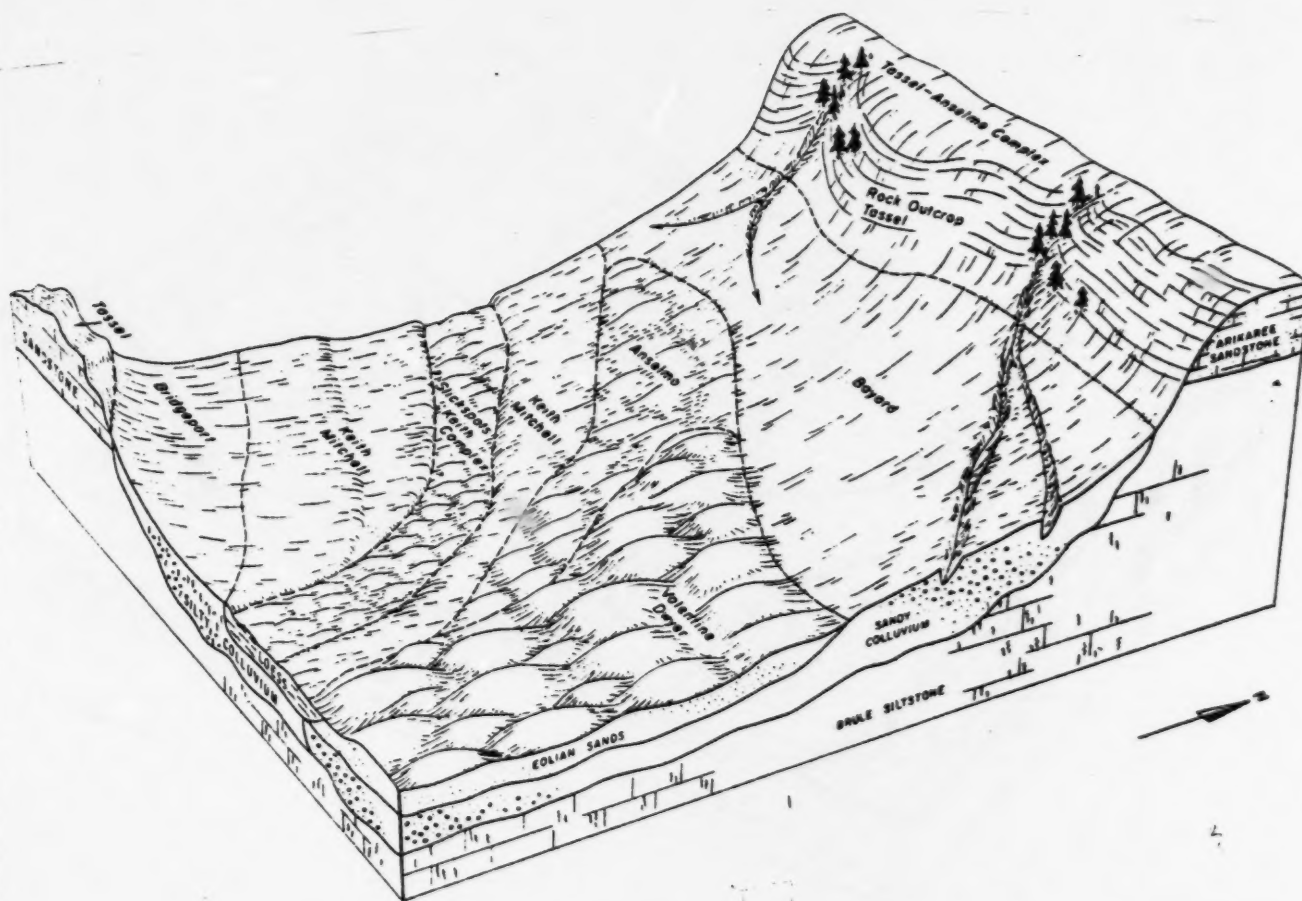


Figure F-4

Major Soil Series and Underlying Material of the
Mitchell-Otero-Buffington Association

APPENDIX G
DESCRIPTIONS OF MAJOR INDUSTRIAL
WASTEWATER CONTRIBUTION

Appendix G

Industry Descriptions

Flanery Foods, Inc. -- This plant, formerly Scottsbluff Packing Company under prior ownership, is located in the southeast section of Scottsbluff. Only beef are slaughtered here with approximately 70 percent of their product shipped as carcass and 30 percent as deboned meat. During December, 1976 the plant processed an average of 348 head per day or approximately 300,000 pounds live weight kill (lb LWK). This represents a decrease in production of approximately 7 percent compared with production during May, 1974 when Bell, Galyardt, and Wells conducted a sampling program of the plant's wastewater. Flanery Foods, Inc. reports no plans for increasing production although cooler capacity, which is the major, non-market limitation on slaughter house production, is currently used at about 75 percent capacity. The plant employs 100 persons including 12 office employees and operates 10 hours per day, 5 days per week.

Four wastewater streams were identified during a tour of the facilities in February, 1977. These were the floor wash-up in the continuous rendering plant, cattle holding pen wash-up, slaughter and deboning operation wastewaters, and condenser cooling waters. All of these streams enter the sanitary sewers except condenser cooling waters which are discharged to storm drains.

The rendering plant utilizes a continuous dry process for reducing inedible products and wastewaters from this operation are limited to those generated by floor wash-up. This waste stream discharges to an 18' x 6' x 5' deep catch basin from which grease is manually skimmed daily for transport and disposal in the Scottsbluff landfill.

Pen wash-up wastes pass through two small solids collection sump from

which solids are manually removed and trucked off-site with paunch material for use as agricultural fertilizer. The overflow from these sumps discharge to the sanitary sewer.

Slaughter and deboning wastewaters represent the major waste load which leave the plant by two or more sewer pipes each equipped with a small solids collection sump approximately 3' x 4' x 3' deep. Only settleable solids are removed in these sumps. They do not collect any floating O&G materials. The sumps and baskets which are in the floor drains are the only means available for removing solid wastes contained in the slaughter and deboning waste stream. Blood is collected for off-site processing and hides are salted and shipped for off-site processing. Viscera, bone, scraps of meat and fat collected in the Hogi drains and catch basins are sent to the rendering plant.

The wastewater data available for this plant was obtained in May, 1974 while still under the management of the Scottsbluff Packing Company. At that time the average production was 332,000 pounds LWK per day. Production by Flanery Foods in December 1976 averaged about 300,000 pounds LWK per day. This was reported to represent 75 percent of maximum capacity, therefore, 400,000 pounds LWK per day was used as the projected production capacity of this facility. The waste loads, in pounds per 1,000 pounds LWK per day were obtained when the plant production was 332,000 pounds LWK per day. These values were increased by a factor of 1.2 to reflect the waste loads at the projected maximum production rate of 400,000 pounds LWK. The present and projected waste loads developed are summarized in the following Table.

Table G-1

Present and Projected () Waste Loads for Flanery Foods, Inc.

	<u>BOD₅</u>	<u>Suspended Solids</u>	<u>Oil and Grease</u>	<u>Total Kjeldahl Nitrogen</u>
mg/l	1053	1210	547	50
lbs/day	3732 (4524)	4190 (5080)	1993 (2416)	183 (222)
lbs/100 LWK	11.2	12.7	6.2	0.6

	<u>gal./1000 lb LWK</u>	<u>mgd</u>
Present Flow	1285	.385
Projected Flow	1000	.400

Because of a lack of reliable water use data for the plant, the projected flow for Flanery Foods is based on a process flow of 1,000 gallons per 1000 pounds LWK, which was the value developed for Stanko Packing and Swift & Co. The flow measurement data available for Swift and Stanko was carefully evaluated and it was established that significant quantities of clean water could be segregated and discharged to storm rather than sanitary sewers. A conservative estimate of this clean water volume indicated that the process water-use could be reduced to 1000 gallons per 1000 pounds LWK. An on-site survey of each of the plants suggested that the rate of process water consumption for each should be relatively equal. Clean cooling water at Flanery Foods is already discharged to the storm sewer, which accounts for their reduced water consumption rate, i.e., 1285 gallons per 1000 pounds LWK compared to 1428 and 1552 gallons per 1000 pounds LWK for Stanko and Swift, respectively. Since the three production plants are similar it is reasonable

to expect that each could reduce their water consumption to equal levels. Therefore with additional clean water segregation and improved housekeeping and maintenance programs for relatively low capital cost the projected average flow for Flanery Foods, Inc. could be reduced to 1000 gallons per 1000 pounds LWK or 0.3 MGD. This represents a reduction in the rate of process water consumption of 22 percent.

This plant is presently operating at full capacity and there were no plans for increasing its capacity in the foreseeable future. Projections for providing pretreatment facilities have been made and depend largely on the economics associated with future treatment costs charged by the City of Gering. Depending on these charges Swift proposes to decrease present waste loads by (1) 50% BOD and TSS and 75 O&G or (2) 75% BOD, 65% TSS and 75% O&G.

Swift and Co., does not anticipate increased production, in fact it has announced the closing of this facility. It is probable that this facility will not remain idle permanently since it is in excellent condition and equipped with up-to-date mechanical equipment. Therefore, for this study existing data is used to project future waste loads from this facility. This plant is the largest meat packing plant in the area, averaging 530,000 pounds LWK during a 1975-76 twelve month period. For the four day sampling program reported in the Gering Facilities Plan, the production averaged 442,000 pounds LWK therefore, the waste loads obtained by the sampling program were increased in proportion to this production ratio and used as the projected waste loads for this facility, which are shown in the following table.

Table G-2
Present and Projected () Waste Loads for Swift & Co.

	<u>BOD₅</u>	<u>Suspended Solids</u>	<u>Oil and Grease</u>	<u>Total Kjeldahl Nitrogen</u>
mg/l	1085	1560	250	72
lbs/day	5430 (6516)	7470 (8964)	1280 (1536)	355 (426)
lbs/100 LWK	12.29	16.9	2.9	0.8

Present Flow	<u>gal./1000 lb. LWK</u> 1552	<u>mgd</u> .69
Projected Flow	(1000)	(.53)

Flow measurements indicated that a considerable volume of water left the plant even while it was shut-down. It was determined that much of this water was clean cooling water associated with the refrigeration system that could be recycled or discharged separately. Approximately half of the measured minimum flow was deducted from the daily average flow to determine projected wastewater volumes. Based on this procedure the value of 1,000 gallons per 1,000 pounds LWK was used to arrive at a projected flow of .53 MGD for this plant. This represents a 36 percent reduction in the present rate of process water consumption.

Stanko Packing Co., Inc. - This plant is located on the east side of the City of Gering. This beef slaughterhouse falls in the category of low-processing meat packing plant as defined by the EPA effluent limitations guidelines report. The plant slaughters only beef, however, it processes all the beef and its entire production is shipped in packed cartons, no carcass leaves the plant. There is therefore, an extensive deboning production line and grinding, cutting and packing operations are involved. However, there is no rendering plant and hides, paunch viscera, bones and blood are trucked from the plant for off-site processing. The plant employs 128 people including 12 office personnel. They operate one 10 hour shift per day for 5 1/2 days per week.

The internal pollution control facilities include blood separation drains and a blood collection tank. Floor drains are equipped with baskets for removal of large pieces of meat and bone. These baskets are emptied as required and the materials collected for off-site rendering. Dry paunch dumps are collected in a truck and hauled off by local farmers as fertilizer. Hides are collected and transported by truck for off-site processing. All the process waste water sewers and the pen wash-up sewers are piped to the inlet of a grease trap. This five by ten by six foot deep catch basin is

designed to collect floating grease and settleable solids. The grease is skimmed off manually and the sludge pumped out and both are trucked to off-site rendering. The efficiency of this small unit depends on the frequency of the sludge and grease removal operations. Once a day clean-out would be a minimum for a catch basin of this size since it provides at most 10 minutes retention for 300 gpm flow. If the basin is allowed to become more than half full there will be little reduction in either grease or solids. However, at present the grease is removed three times a day and settled sludge is pumped out twice a month.

The plant presently processes 185 head of beef per day averaging 180, 375 lbs. LWK per day. Management projects an increase in production during the next few years to a maximum of 260 head or 250,000 lbs. LWK per day. This represents the maximum capacity of their cooler which is the limiting factor effecting production other than market conditions.

Based on a projected production rate of 250,000 pounds LWK, the wasteloads determined during the sampling program when the plan production average 189,000 pounds LWK were increased proportionately. The present and projected wasteloads are shown in the following table.

Table G-3

Present and Projected () Wste Loads and Flows for STANKO Corp.

	<u>BOD₅</u>	<u>Suspended Solids</u>	<u>Oil and Grease</u>	<u>Total Kjeldahl Nitrogen</u>
mg/l	980	960	128	80
lbs/day	2190 (2897)	2150 (2844)	290 (384)	180 (238)
lbs/100 LWK	11.6	11.4	1.5	.95
		<u>gal./1000 lb LWK</u>	<u>mgd</u>	
Present Flow	1428		.27	
Projected Flow	(1000)		(.25)	

The projected process wastewater volume was developed from evaluation of the flow measurement information available for this plant. From this study it became apparent that there is a significant volume of water leaving the plant during hours that the plant is completely shut-down. Discussion with the plant personnel determined that it was clean cooling water, utilized in one way or another in their refrigeration system. This water can be segregated and discharged separately or recycled to the fresh water storage tank. Based on the flow measurements made during the four day survey, which is supported by the city flow recorder on the combined flows of Swift and Stanko, projected water use has been reduced from 1428 gallons per 1000 pound LWK to 1000 gallons per 1000 pound LWK. This value was determined deducting only half the measured minimum flow recorded during plant shut-down periods, therefore it is a conservative value achievable by improved cooling water handling systems. The projected water volume for Stanko Packing is therefore .25 MGD when production reaches 250,000 pounds LWK. This represents a reduction in the present rate of process water consumption of 30 percent.

CRA Inc. - CRA Inc., a wholly owned subsidiary of Farmland Industries Inc., is a small oil refinery located on the south side of Scottsbluff. This plant processes 5000 barrels of crude oil per day and operates 24 hours per day 7 days per week. The plant production processes include crude distillation, gasoline refining, fluid catalytic cracking and polymerization. Internal pollution controls are employed on the sour water waste stream from the catalytic cracking process. Natural gas stripping of this stream reduces its phenol, ammonia and hydrogen sulfide content prior to discharge to the main waste stream. The plant operates an API separator for removal and recovery of oil which is then reprocessed.

The raw waste stream discharged from the plant is piped to a series of four lagoons for biological treatment. The first lagoon is equipped with two

15 horse power surface aerators and the remaining three provide natural oxidation. Utilizing a 5 foot water depth, the system provides approximately 5 days detention time. Oil accumulates only in the first two lagoons which are hand skimmed occasionally. The last two lagoons are oil free and require minimal maintenance time to insure efficient operation. The discharge is metered with a parshall flume which is recorded once a day. These readings are used as a basis for the determination of city sewer charges. During the years 1970-71 at the request of the State, the plant tested for chromates and zinc which remained at concentrations less than 0.1 mg/l throughout the test period. On this basis the State no longer requires CRA to report on these heavy metal constituents.

The discharge from the lagoons formerly entered the North Platte River, however, they are now discharging to the City of Scottsbluff sewer system by gravity flow.

Daily grab samples of the treated discharge from the API-lagoon system indicates that substantial reductions in waste constituents are achieved. During the warm weather months the effluent approaches a quality that is in compliance with EPA point source discharge limitations. During the cold weather months these limitations are exceeded by a nominal amount, i.e., average BOD is 35 mg/l, TSS 20 mg/l and O&G 30 mg/l. The low concentrations of these constituents will exert little influence on the treatment efficiency of the City treatment plant.

CRA Inc. does not, at present, have any plans for expanding its existing production facilities. This is, of course, subject to change depending on marketing conditions. However, they are operating near design capacity now and major production facility changes would be required to increase production capabilities significantly.

During the year 1976 the total wastewater discharged averaged .18 MGD with the following average constituents: BOD 25 mg/l, TSS 19 mg/l, O&G 17 mg/l, phenols 4 mg/l and NH_3 5.2 mg/l. These figures were used as the estimate of the projected flows and waste loads for CRA.

Lockwood Corporation - This is the largest single industry in terms of total employees of all those located in the Scottsbluff, Gering, Terrytown area. This plant is a division of Alaska Interstate Corporation and employs a total of 900 people composed of 350 office personnel and 550 production personnel. The plant operates on a 5 1/2 day week with two shifts per day for the manufacturing plant.

The manufacturing operations utilized fall in the metal working classification. There are four basic processes which contribute to the total waste water generated by the facility. Listed in the order of their greatest contribution to the waste stream, these operations are:

1. Galvanization
2. Painting operations
3. Chain manufacturing
4. Machine shop and welding operations

The galvanizing process generates two waste streams: rinse water, a relatively weak waste, is acidified and then neutralized prior to discharge to the city sewer system. The other waste stream is a strong waste consisting of galvanizing tank dump water which is discharged in 12,000 gallon batches every 11 days to an evaporation pond and does not enter the sanitary sewers. Painting operations involve acrylic paints for the most part, and the wastewater generated is treated using iron phosphate prior to discharge to the city sewer system. The chain manufacturing operations generate about 700 gallons per month of wastes containing zinc phosphate. The wastewater from the machine shop and welding operations contains metal filings, oil and grease and synthetic

oils. The oils are biodegradable in conventional municipal waste treatment systems. The total volume of water purchased from the city averages .177 MGD for a 5 1/2 day week. Deducting 1000 gpd discharged to evaporation ponds, the discharge to the city sewer would equal .176 MGD less minor losses.

There are no plans for increasing production capabilities and, therefore, the quantity of wastewater generated is not expected to increase in the future. Conversely, it is planned to transfer the production of irrigation equipment to other facilities within the next two years. This will eliminate the waste generated by the galvanizing process. Thus, the 200 gal./month wastewater containing zinc phosphate may then be discharged to the evaporation ponds now used for galvanized wastewaters.

Lockwood Corporation is located in an industrial park consisting of 15 or 20 small, generally, dry manufacturing or service plants. The wastewater generated by the entire industrial park is transported in a single pipeline to the City of Gering waste treatment plant which is one mile to the north of the park. Because these wastewaters are separable from domestic wastewaters, it would be possible to pretreat them in the future if for any reason this is found to be necessary. Pretreatment beyond that performed within the Lockwood plant is not recommended at this time. No data is available on the chemical composition of Lockwood's wastewater. The primary pollutant of concern is zinc from galvanizing (which will be eliminated within two years) and chain manufacturing. Concentration of zinc and other heavy metals in Gering's wastewater treatment plant effluent, as sampled by Bell Galyardt and Wells, were all below detection limits of the analytical methods used. Composite sampling and thorough chemical analysis of wastewaters from the Lockwood plant and from the industrial park as a whole are recommended to determine the presence or absence of pollutants which may be incompatible with Gering's wastewater treatment facilities.



State of Nebraska
Department of
Environmental Control

J. James Exon
Governor

Dan I. Damm
Director

Mail, Box 94653 State House Station Office, 1424 'P' Street Lincoln, Nebraska 68509 (402) 471-2186

October 31, 1977

Mr. Paul M. Walker
Chief Engineering Branch, Water Division
U.S. Environmental Protection Agency
Region VII
1735 Baltimore
Kansas City, Missouri 64108

RE: Scottsbluff, Nebraska, Project No. C310474-01
and Gering, Nebraska, Project No. C310631-01

Dear Mr. Walker:

Enclosed are copies of the results of samples collected from wells near the Scottsbluff lagoons and Lockwood Corporation near Gering. This should provide the information requested in a letter to Mike Swiggart on 12 October 77.

If this information is not sufficient, please contact me as I may be able to supply more about the observations made during my inspection. I wanted to get the results of the chemical analysis to you as quickly as possible.

Sincerely,

John A. Knapp
Surveillance Specialist
Department of Environmental Control
200 South Silber
North Platte, Nebraska 69101

JAK/jh
Encls.

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NOV 18 1977

ENGINEERING BRANCH
WATER DIVISION

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*Lockwood Corp., Gering, Galvanizing Waste Stream

Date	77-10-21
Time	1430
Air Temp - °C	
pH	6.6
Turbidity, NTU	
Total Dissolved Solids	
Phosphate, Ort. as P	
Nitrate, Total as N	
Fecal Coliform per 100 ml	
Oil & Grease	
Metals:	
Zn	30.9
Cr	.01
Fe	17.5
Cd	.02
Cu	.06
Mn	.18

* NOTE: Chemical results expressed as mg/l unless otherwise specified.

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*Lockwood Corp., Gering, Sewer Line Directly Upstream
of Lockwood Corp. Input

Date	77-10-21
Time	1430
Air Temp - °C	
pH	8.7
Turbidity, NTU	
Total Dissolved Solids	
Phosphate, Ort. as P	
Nitrate, Total as N	
Fecal Coliform per 100 ml	
Oil & Grease	82.0
Metals:	
Zn	2.2
Cr	.01
Fe	2.0
Cd	.01
Cu	.58
Mn	.08

*NOTE: Chemical results expressed as mg/l unless otherwise specified.

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NOV 18 1977
ENGINEERING BRANCH
WATER DIVISION

*Lockwood Corp., Gering, Sewer Lift Station Directly below Lockwood Corp.

Date	77-10-21
Time	1430
Air Temp - °C	
pH	7.0
Turbidity, NTU	
Total Dissolved Solids	
Phosphate, Ort. as P	
Nitrate, Total as N	
Fecal Coliform per 100 ml	
Oil & Grease	55.0
Metals:	
Zn	29.3
Cr	.18
Fe	55.5
Cd	.03
Cu	.55
Mn	.30

NOTE: Chemical results expressed as mg/l unless otherwise specified.

REPORT OF INSPECTION

Corporation: Lockwood Corp., Gering, Nebraska

Inspector(s): B. A. Hammon, John Knapp
prepared by B. A. Hammon

Date: October 21, 1977

Purpose of Visit: EPA request for Environmental Impact Statement

<u>Principle Product:</u>	Potatoe Equipment	a. harvesters b. planters c. defoliators
	Beet Equipment	a. harvestor
	Vegetable Equipment	a. special order equipment b. conveyors
	Spraying Equipment	a. fruit treee sprayers b. row crop sprayers
	Dry edible beam	a. harvesting equipment
	Center Pivot Equipment	

Contacts: John Teegerstrom = Director of Employee & Community Relations
Roy R. Dugan = Maintenance Manager

Process Narrative: Heavy Equipment Manufacture including fabrication, welding assembly, machining, galvanizing

Waste Charactor to Sanitary Sewer:

1. One storm drain
2. Galvanizing waste
3. Domestic sewage
4. Cooling water; contact, non-contact

Industrial Waste Generated from:

Paint line: enamel paint, wash & rinse as pre-treatment for painting-painted-water soluable coolant used in steam generating plant-discharge to city system.

Machine Plant: water soluable agent used to pick-up grit used for cooling then drain to City. Some oil & grease, however, they have a grease trap which is periodically cleaned.

Outside Storm drain: one small area served by storm drain goes to city sanitary sewer with grease trap as pre-treatment

Chain Forging Plant

Chain Forging Furnaces: oil quenching system, however, system is closed
Pretreat before chains enter furnace-phosphatizing to pretreat using iron phosphate as principle agent.

Pipe welding operation: welding guns have non-contact cooling water, goes to City.

Pipe forging mill: used 50% of the year, cooling water with soluble trim added, trim container does not have an environmental warning.

Galvanizing Operation: caustic and acid goes to lagoon, rinse water from operation goes to City (potential zinc source)

Emergency spill would be discharged to lagoon and not city system.

SUMMARY: The Lockwood Corp. plant has basically four (4) types of flow entering the sanitary sewer.

1. Domestic sewage from 750 employees over two-eight hour shifts per day, five days per week.
2. One small storm drain area near a loading dock which has a grit/grease removal system prior to entry of sanitary sewer.
3. Galvanizing rinse waste discharging to city sanitary with a potential for heavy metals particularly zinc. Caustic and acid waste goes to self-contained lagoon which also catches emergency spills from vats in the event an accident occurs.
4. Cooling water- contact cooling water with agent for attracting particulates goes to grit/grease unit then discharges to City. Potential oil grease source and TSS contribution. Non-contact cooling water which contributes to volume of water discharged to City.

Samples taken at the time of this visit are enclosed for your information.

General plant plans are enclosed and depict process areas in relation to plant.

For additional information contact:

Mr. John Teegerstrom
Director of Employee Relations and Community Relations
308-436-5051

Mr. Roy Dugan
Maintenance Manager
308-436-6331

Mr. Gunther Kool
Process Chemist
308-436-5051

STATE OF NEBRASKA DEPARTMENT OF ENVIRONMENTAL CONTROL

WATER QUALITY MONITORING ANALYSIS

Stream N Platte River Station Name Lockwood CERP. Grading

Sampling Point Discharge Wast Collector Kraft, John Morgan City M

CARD #1 (Severity symbols: 0=None, 1=Mild, 2=Moderate, 3=Serious, 4=Extreme).

STATION CODE SERIAL	-----	SLUDGE, FLOATING	(01315)
DATE (Yr. Mo. Day)	7.7.11.11.12.11	DEBRIS, FLOATING	(01345)
TIME (24 hr. Clock)	1431	FISH, DEAD	(01340)
CLOUD COVER % (00032)	---	ODOR, ATMOSPHERIC	(01330)
STREAM FLOW, SEVERITY (01351)	---	SEWAGE SOLIDS, FRESH	(01335)
ALGAE, FLOATING MATS (01325)	---	AIR TEMPERATURE, °C (00020)	---
DETERGENT, SUDS (01305)	---	WATER TEMPERATURE, °C (00010)	---
GARBAGE, FLOATING (01320)	---	D. O., mg/l (00300)	---
ICE COVER (01355)	---	pH, su (00400)	6.6-6
OIL OR GREASE (01300)	---	STREAM FLOW, CFS (00060)	---

Chemical Results Expressed as mg/l (ppm)

Prefix (0, For Not Accurate) (1, For Less Than) (2, For Greater Than) (3, For Calculated Value Same as or = C)

CARD #2	TYPE A
COND. u mho/cm (00095)	SOLIDS, DISSOLVED RESIDUE (70300)
TURBIDITY, JKSN JTU (00070)	SOLIDS, SUSPENDED (70299)
CHLORIDE, as Cl (00940)	PHOSPHATE, Ort. as PO ₄ (00660)
SODIUM, DISSOLVED as Na (00930)	NITRATE, Tot. as N (00620)

CARD #3	TYPE B
BOD, 5 DAY (00310)	CHLORINE, Tot. Residual (50060)
COD, Hi Level (00340)	FECAL COLI., 100 ml. (31616)
NITROGEN, AMMONIA, Tot. (00610)	

SPECIAL ANALYSIS REQUESTED

GREASE AND OIL (32250)	()
()	()
()	()

REMARKS Run Hotel with all you can

Zn 30.9 mg/l mn. 18

Cr .01

Fe 17.5

Cd .02

STATE OF NEBRASKA DEPARTMENT OF ENVIRONMENTAL CONTROL

WATER QUALITY MONITORING ANALYSIS

Stream N 103 R Station Name Lebanon Corp. Quarry
Sampling Point Upst of Plant discharge Collector Raymond M. Gering

CARD #1 (Severity symbols: 0=None, 1=Mild, 2=Moderate, 3=Serious, 4=Extreme).

STATION CODE SERIAL	_____	SLUDGE, FLOATING	(01315)	_____
DATE (Yr. Mo. Day)	<u>7.7.1961</u>	DEBRIS, FLOATING	(01345)	_____
TIME (24 hr. Clock)	<u>1430</u>	FISH, DEAD	(01340)	_____
CLOUD COVER % (00032)	_____	ODOR, ATMOSPHERIC	(01330)	_____
STREAM FLOW, SEVERITY (01351)	_____	SEWAGE SOLIDS, FRESH	(01335)	_____
ALGAE, FLOATING MATS (01325)	_____	AIR TEMPERATURE, °C	(00020)	_____
DETERGENT, SUDS (01305)	_____	WATER TEMPERATURE, °C	(00010)	_____
GARBAGE, FLOATING (01320)	_____	D. O., mg/l	(00300)	<u>8.7</u>
ICE COVER (01355)	_____	pH, su	(00400)	<u>8.7</u>
OIL OR GREASE (01300)	_____	STREAM FLOW, CFS	(00060)	_____

Chemical Results Expressed as mg/l (ppm)

Prefix (0, For Not Accurate) (1, For Less Than) (2, For Greater Than) (3, For Calculated Value, same as or = C)

CARD #2	TYPE A
COND. u mho/cm (00095)	SOLIDS, DISSOLVED RESIDUE (70300)
TURBIDITY, JKSN JTU (00070)	SOLIDS, SUSPENDED (70299)
CHLORIDE, as Cl (00940)	PHOSPHATE, Ort. as PO ₄ (00660)
SODIUM, DISSOLVED as Na (00930)	NITRATE, Tot. as N (00620)

CARD #3	TYPE B
BOD, 5 DAY (00310)	CHLORINE, Tot. Residual (50060)
COD, Hi Level (00340)	FECAL COLI., 100 ml. (31616)
NITROGEN, AMMONIA, Tot. (00610)	

SPECIAL ANALYSIS REQUESTED

GREASE AND OIL (32250)	<u>82.0 mg/l</u>	()
()	()	()
()	()	()

REMARKS Line from river whole in garden

zn 2.2 mg/l
Cr .01
Fe 2.0
Al .01
Cu .58
Mn .08

STATE OF NEBRASKA DEPARTMENT OF ENVIRONMENTAL CONTROL

WATER QUALITY MONITORING ANALYSIS

Stream N. Platte R Station Name Lockwood Bridge
 Sampling Point downstream of plant discharge Collector Knapp, John, M. M. M. M.

CARD 01 (Severity symbols: 0=None, 1=Mild, 2=Moderate, 3=Serious, 4=Extreme).

STATION CODE SERIAL	-----	SLUDGE, FLOATING	(01315)
DATE (Yr. Mo. Day)	77.1.19.1.21	DEBRIS, FLOATING	(01345)
TIME (24 hr. Clock)	1430	FISH, DEAD	(01340)
CLOUD COVER % (00032)	---	ODOR, ATMOSPHERIC	(01330)
STREAM FLOW, SEVERITY (01351)	---	SEWAGE SOLIDS, FRESH	(01335)
ALGAE, FLOATING MATS (01325)	---	AIR TEMPERATURE, °C	(00020)
DETERGENT, SUDS (01305)	---	WATER TEMPERATURE, °C	(00010)
GARBAGE, FLOATING (01320)	---	D. O., mg/l	(00300)
ICE COVER (01355)	---	pH, su	(00400) 7.0
OIL OR GREASE (01300)	---	STREAM FLOW, CFS	(00060)

Chemical Results Expressed as mg/l (ppm)

Prefix (0, For Not Accurate) (1, For Less Than) (2, For Greater Than) (3, For Calculated Value, Same as or = C)

CARD 02 TYPE A

COND. u mho/cm (00095)	-----	SOLIDS, DISSOLVED RESIDUE (70300)	-----
TURBIDITY, JKSN JTU (00070)	-----	SOLIDS, SUSPENDED (70299)	-----
CHLORIDE, as Cl (00940)	-----	PHOSPHATE, Ort. as PO ₄ (00660)	-----
SODIUM, DISSOLVED as Na (00930)	-----	NITRATE, Tot. as N (00620)	-----

CARD 03 TYPE B

BOD, 5 DAY (00310)	-----	CHLORINE, Tot. Residual (50060)	-----
COD, Hi Level (00340)	-----	FECAL COLI., 100 ml. (31616)	-----
NITROGEN, AMMONIA, Tot. (00610)	-----		

SPECIAL ANALYSIS REQUESTED

GREASE AND OIL (32250)	55.0 mg/L	()
()	()	()
()	()	()

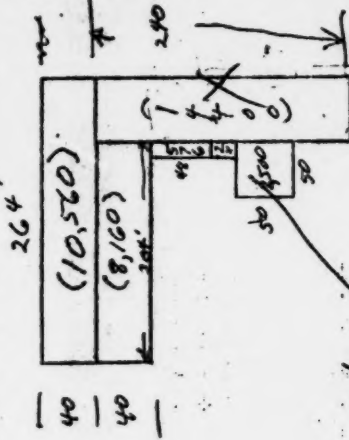
REMARKS Water from all that year

Zn 293 mg/L
 Cr 18
 Fe 55.5 Cu .55
 Mn .03 Mn .30

Plant layout file

10560
8160
14400
2500
576

Plant II 36,196 sq ft



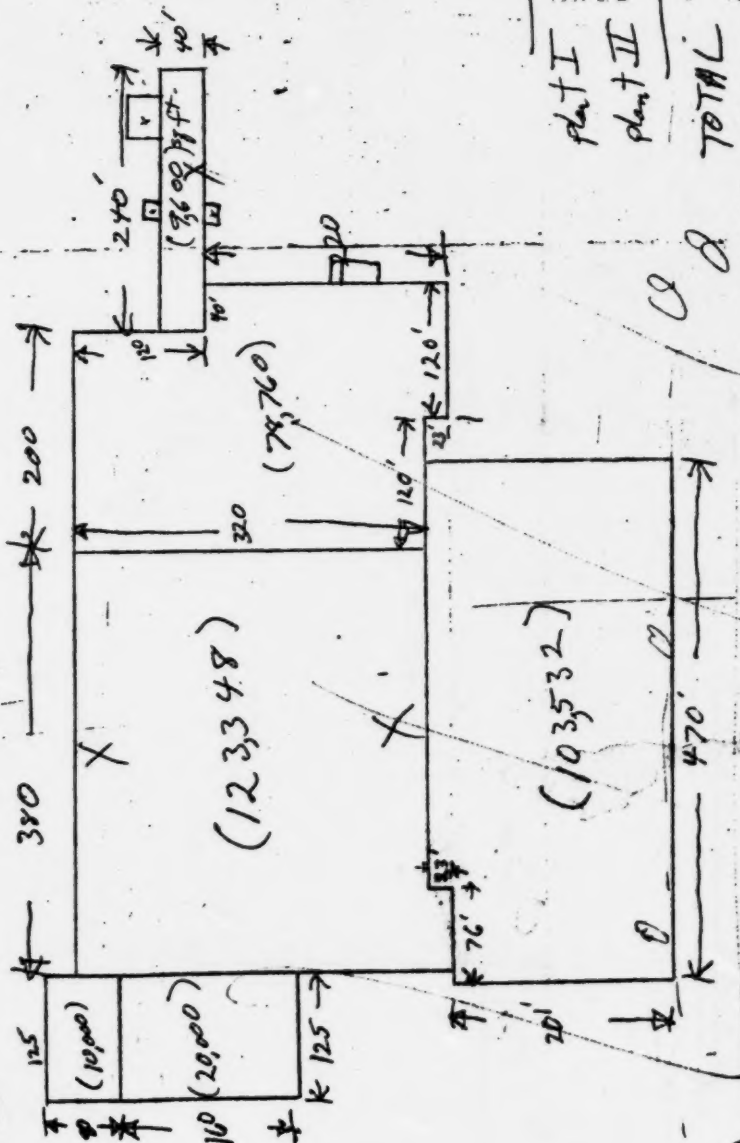
S. J. P. Calvin, Jr. Eng.

Roy R. Dugan
9/5/75
8/1/76

9/5/75

sq ft. ÷ 43,560 = 95261
Acres

sq ft. = new addition



123348
103532
78760
20000
9600

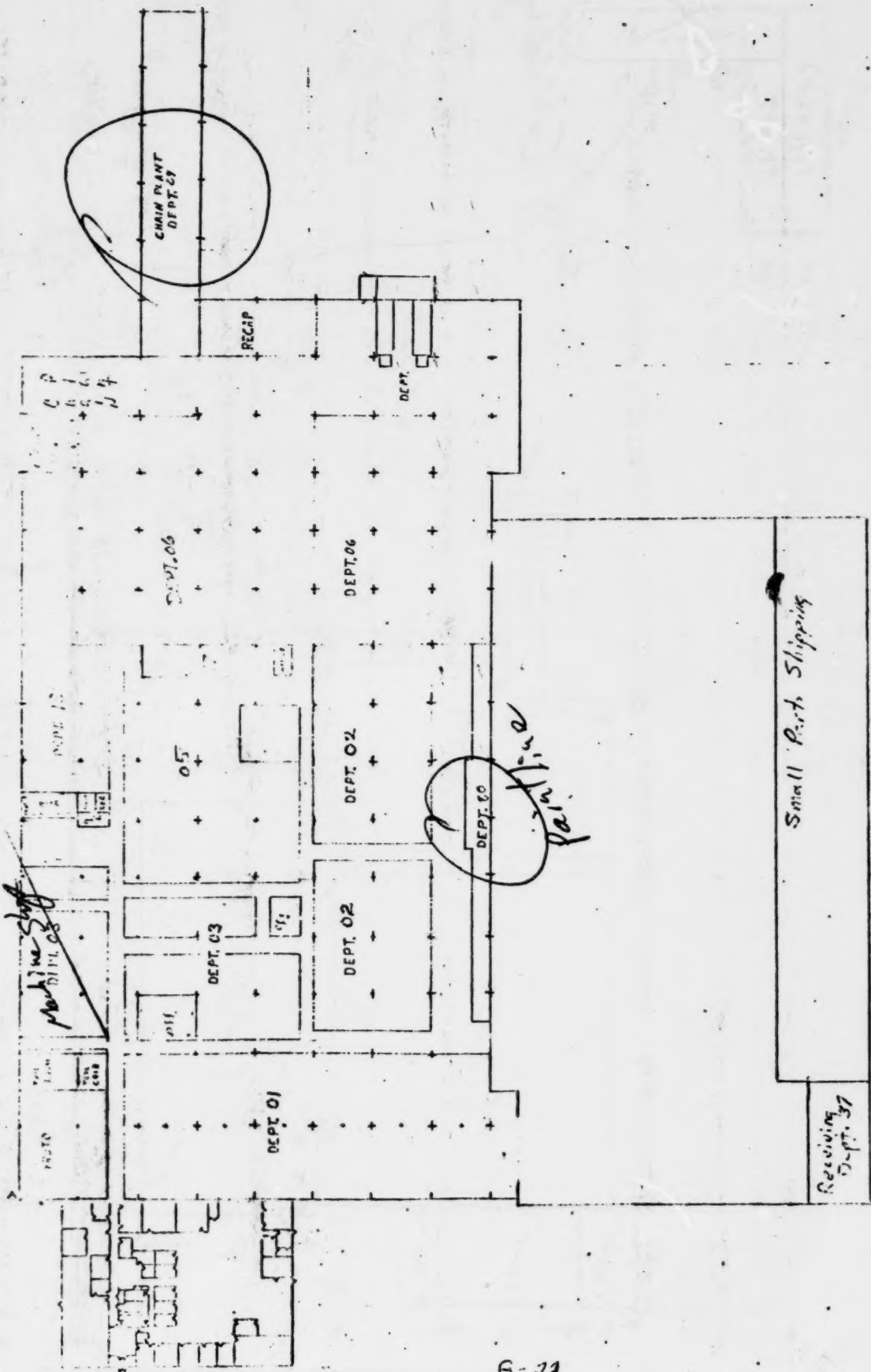
Plant I 335240

Plant II 36196

TOTAL 371436

+ 10,000

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APPENDIX H

LOCAL ECONOMIC AND
MANUFACTURERS DATA

Table H-1

Number of Farms in Scotts Bluff and Sioux Counties
(Selected Years)

Year	County	
	Scotts Bluff	Sioux
1960	1,620	495
1966	1,390	430
1968	1,300	405
1970	1,240	400
1971	1,210	400
1972	1,180	395
1973	1,170	395
1974	1,160	390
Annual average rate of change (Percent)	-2.4	-1.7

SOURCE: Neb. Dept. Agric. Annual Nebraska agricultural statistics in Neb. Dept. Econ. Dev. 1975 and 1976 Nebraska statistical handbook, 1974-1975 and 1976-1977. Lincoln, Neb. p. 73.

Table H-2. EMPLOYMENT IN THE SCOTTSBLUFF-GERING LABOR MARKET

A. Employment in the Scottsbluff-Gering labor market which is defined as the whole of Scotts Bluff County (annual average, 1975):

<u>Nonagricultural</u>	<u>Male</u>	<u>Female</u>	<u>Total</u>
Manufacturing	1,792	948	2,740
Mining & Construction	639	11	650
Utilities, Transportation & Communications	916	134	1,050
Trade, Wholesale & Retail	1,989	1,911	3,900
Finance, Insurance & Real Estate	260	140	400
Services	516	1,634	2,150
Government	832	1,248	2,080
All other nonagricultural	<u>1,450</u>	<u>780</u>	<u>2,230</u>
Total nonagricultural	8,394	6,806	15,200
Agricultural	<u>1,770</u>	<u>360</u>	<u>2,130</u>
TOTAL	10,164	7,166	17,330

B. Current unemployment (yearly average)

<u>Male</u>	<u>Female</u>	<u>Total</u>
348	232	580

C. Estimated number of housewives, seasonal and part-time workers, and workers who would shift from low-paying jobs that could be expected to work for industry:

<u>Male</u>	<u>Female</u>	<u>Total</u>
643	423	1,066

D. Estimated number of county high school graduates annually:

<u>Male</u>	<u>Female</u>	<u>Total</u>
699	748	1,447

E. Estimated number of workers commuting to other communities to work:

<u>Male</u>	<u>Female</u>	<u>Total</u>
40	10	50

F. Total potential labor supply (B, C, D, & E):

<u>Male</u>	<u>Female</u>	<u>Total</u>
1,730	1,413	3,143

SOURCE: Neb. Public Power Dist. 1976. Industrial facts. Scottsbluff and Gering, Nebraska. Columbus, Neb. p.9

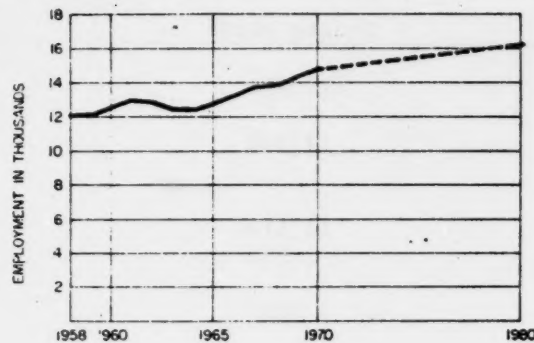


Figure H-1 TOTAL EMPLOYMENT, SCOTTSBLUFF
COUNTY 1958-1970 WITH A
PROJECTION FOR 1980.

SOURCE: Neb. Dept. Econ. Dev., Res. Div. 1972.
Economic growth performance study.
Prepared for Neb. Dept. Roads. p.3.

Table H-3

Work Force Summaries for Scotts Bluff
and Sioux Counties, Nebraska, (1975)

	County	
	Scotts Bluff	Sioux
Total Work Force	17,910	830
Total Employment	17,330	805
Nonagricultural		
Wage and salary	13,110	215
All other	2,230	55
Agricultural	2,000	535
Unemployment		
Number	580	20
Rate	3.2	2.7

SOURCE: Neb. Dept. Labor. No Date. Work force summaries in Neb.
Dept. Econ. Dev. 1976. Nebraska statistical handbook,
1976-1977. p. 43.

Table H-4. Manufacturers in Scottsbluff and Gering, Nebraska

City or Town	Manufacturer	No. of employees	SIC Code	Product(s)
Gering	SCOTTS BLUFF COUNTY			
	Blue J Feeds, Inc.	B	2048	Poultry, cattle and hog feed
	Gering Courier	A	2751 2711	Commercial printing Weekly newspaper
	Gifford-Hill & C., Inc.	B	3272	Concrete irrigation pipe
	Goodwin Printers	A	2751	Commercial printing
	Great Western Sugar*	D	2063	Pure beet sugar, Sugar beet by-products
	Karem By-Products, Inc.	B	2077	De-boning
	Lichter Duo-Rest, Inc.	D	2391 2515 2511	Drapery Box springs and mattresses Mobile home and household furniture
	Lockwood Corp.*	H	3523	Potato, beet and onion machinery, Irrigation equipment, Row crop and orchard sprayers, Nut and edible bean harvesting equipment.
	Lukens Tool & Die Co.	B	3469 3355 3544	Metal stampings Custom roll formings Tools and dies, Jigs and figures, Plastic molds
	Micro Mfg. & Machine, Inc.	A	3599	General machine shop, Welding
	Nebraska Mobile Home Mfg. Corp.	E	2451	Mobile homes
	Siehe Manufacturing	A	3321 3361 3443 3362	Cast iron foundry Aluminum foundry Tank and other steel products Brass foundry
	Stanko Packing*	C	2011	Beef Processing, Beef by-products
	Western Ranch Products	A	2048	Livestock minerals

Table H-4 - Cont'd.

City or Town	Manufacturer	No. of employees	SIC Code	Product(s)
Scottsbluff	Ace Neon Co.	A	3993	Signs
	B & C Steel Corp.	D	3449 3441	Steel prefabricated buildings Fabricated structural steel members
	Business Farmer Printing Co.	B	2751 2721	Commercial printing Print "The Business Farmer"
	C R A, Incorporated	D	2911	Petroleum products
	Cavley's Tater Flakes, Inc.	C	2099	Potato chips
	Circle B, Inc.	B	2048	Poultry and livestock feed
	D & A Manufacturing Co.*	B	3662	Radio communications equipment
	Ferguson Neon & Plastic Sign Co.	A	3993	Neon sign and plastic signs
	Fisher Roofing Co.	A	3442	Metal awnings
	Flanery Foods, Inc.	D	2011	Fabricated meat products, beef slaughtering
	Gibbs Sheet Metal Works	A	3444	Heating, ventilating and cooling ducts
	Gray Manufacturing Co.	A	3444	Metal fabricators
	Great Western Sugar Co.	H	2063	Pure beet sugar, Sugar beet by-products
	Heilbrun Manufacturing Co.	A	3523	Ground driven rotary cultivator units, Hydraulic row finder for beet harvester, Cultivator bar and acces- sories, Land levelers, Combine row crop attachment
	Hydro Conduit Corp.	C	3444 3273 3272 3271	Corrugated metal pipe Ready-mixed concrete Concrete pipe Concrete blocks
	Independent Cable, Inc.*	F	3679 3661	Capacitors, capacitor assemblies Telephone equipment
	Irrigation Specialities Mfg. Co.	A	3523	Sprinkler irrigation equipment, Row crop sprayers, Specialized harvesting equipment
	Lundgren Trailer Mfg. Co.	A	3715	Horse trailers
	Meat House	A	2011	Custom slaughtering and meat products

Table H-4 - Cont'd.

City or Town	Manufacturer	No. of employees	SIC Code	Product(s)
	National Drinks, Inc.	C	2086	Soft drinks
	Platte Valley Creamery	A	2026 2024	Dairy products Ice Cream
	Scottsbluff Ice and Storage Co.	A	2097	Artificial ice
	Scottsbluff Sash & Door	C	2431	Millwork
	Simplot Soilbuilders	C	2875	Fertilizer
	Star-Herald Printing Co.	D	2711	Daily newspaper
	Straetker Machine Shop	A	3713	Truck bodies
	Swift & Co.*	F	2011	Beef and sheep processing, Meat by-products
	Twin City Ready Mix	C	3273	Ready-mixed concrete
	Valley Sign Co.	A	3993	Commercial signs
SIOUX COUNTY				
Harrison	Harrison Sun-News	A	2751 2711	Commercial printing Weekly newspaper

*Exporting. Employment Code: A=under 10; B=10 to 24; C=25 to 49; D=50 to 99; E=100 to 199; F=200 to 499; G=500 to 999; H=1000 to 2499; I=2500 and over.

SOURCE: Neb. Dept. Econ. Dev. 1976b. A directory of Nebraska manufacturers and their products, 1976-1977. Lincoln, Neb. p. 16-155.

APPENDIX I

INFILTRATION/INFLOW REHABILITATION

Infiltration/Inflow Rehabilitation

Scottsbluff - The Infiltration/Inflow (I/I) analysis for the Scottsbluff sewer sytem presented in the August, 1975 Facility Plan concluded that 16 percent of the peak flow entering the wastewater treatment plant was I/I including infiltration of .55 MGD and inflow of 1.25 MGD. Estimation of infiltration in that report compared peak flow data for August and December, 1973 and assumed that infiltration occurred only during winter months when the groundwater table in the City is below the major portion of the sanitary sewers. However, groundwater table elevations reported in a separate I/I analysis (Bell Galyardt and Wells, 1975b) indicate that seasonal variations are minor. Calculation of infiltration rates from peak flow characteristics introduces sources of error which have little to do with sewer elevations or condition.

Examination of weekly sewage flow records obtained from the City of Scottsbluff for the period of December 1975 to June 1976 indicated a change in calibration of the recording apparatus during January, 1976. Whereas average daily flows appear to be relatively unchanged over the period, minimum Sunday night flows increaae from a rather constant .05 - 0.7 mgd to 1.2 - 1.5 mgd during January. Assuming that the recalibration corrected errors, and comparing the 1976 data to Bell, Galyardt and Wells' August, 1973 sampling results of 1.1 - 1.2 mgd minimum week day flows, it appears that 1.2 mgd is an appropriate estimate of current minimum Sunday night flows. This figure represents 60 percent of the August 1973 average daily flow recorded by Bell Galyardt and Wells in their sampling run (included domestic flows only) and 40 percent of average daily flows of 3.0 mgd from February to June 1976 as

recorded on available flow records (including industrial flows). This figure is taken to be a more realistic estimate of the constant, clear-water input to the sewer system. Because of lag times for sanitary sewage to travel from point of generation to the recording device, the 1.2 - 1.5 mgd figure may represent a slight overestimate. Since the apparent underestimation of infiltration in the Facilities Plan results in an overestimation of actual domestic sewage generation, the 100 gallons per capita per day (gpcd) design domestic sewage generation figure used in the Facilities Plan may be an overestimate. The implications for design wastewater flows and for sewer rehabilitation estimates are that projected wastewater flows for the "No Elimination of I/I" and for the "70% Elimination of Infiltration and 80% Elimination of Inflow" alternatives may be overestimates. However, because a substantial amount of field work and time delay would be required to develop more substantial estimates of infiltration, the figures developed by Bell Galyardt and Wells are used in this report in development and costing of alternative wastewater management systems for Scottsbluff.

Estimation of the inflow rate may also have been based on an insupportable assumption, i.e., that highwater marks in manholes along the main interceptor indicate maximum peak flows experienced. Interviews with local officials indicate that the interceptor is used to store sewage during repair on the main pumps at the treatment plant lift station. High water caused by storage would not indicate peak flows, therefore. Examination of the December 1975 to June 1976 flow meter records indicates that there may be periods of abnormally high flow in the sewer system. Quantification of the increase in flow above expected conditions is precluded, however, because the limited capacity of sewage lift pumps below the flow meter causes frequent backups in the Parshall flume. This causes erratic flow measurements and possible overestimation of total flow. Because of the meager rainfall in the area and because the actual

volume contributed by inflow in any case would not significantly affect the design of alternative systems, the quantification of inflow is not an important concern. None of the treatment or discharge options considered here would use peak flows in the sanitary sewer as a major design variable.

The decision to rehabilitate sewer systems for eliminating I/I must be based on a comparison of the present worth cost to rehabilitate vs. the present worth cost to treat the excess flows over the design period (20 years). The estimated costs for rehabilitation of sanitary sewers in Scottsbluff was given in the August, 1975 Facilities Plan as \$765,900. The costs to treat inflow in Scottsbluff are considered to be negligible. Inflow treatment costs derive primarily from increased hydraulic design capacity of transport treatment and disposal facilities. No such increased hydraulic capacity would be necessary except for the treatment alternatives envisioning new activated sludge treatment plants. The costs for treating removeable infiltration are based on Bell Galyardt and Wells infiltration estimate of .55 mgd, an obtainable reduction of infiltration of 70%, and treatment cost per thousand dollars for the least expensive, environmentally acceptable alternative considered here, Scottsbluff alternative S.D. 4 (see Section III.C. 2). The present worth of treating this "removeable" infiltration is \$290,000. Assuming that the actual infiltration rate is 1.2 mgd as discussed above, and that 70% of this constant flow is removeable, the present worth of treating the removeable infiltration would be \$640,000. Comparing these estimates to the previously estimated costs for removing 70 percent of the infiltration leads to the conclusion that it is not cost effective to systematically rehabilitate Scottsbluff's sewer system. Known sources of inflow or infiltration should be corrected and adequate periodic maintenance, as appears to have been provided in the past, should be continued.

Gering - The assumption was made in the preliminary draft of the Facilities Plan for Gering dated January, 1977 that infiltration from groundwater does not exist. This assumption is based on reports by City personnel that their sewers were never constructed in groundwater. However, inspection of flow data reported in the draft Facilities Plan and flow records for one of the domestic sewer flow meters obtained from Gering indicates that a substantial proportion of the domestic wastewater flows is a constant, 24-hour flow. The minimum flows recorded during the April, 1976 sampling period were 58 percent and 30 percent of the average daily flows to the 6-inch and 9-inch Parshall flumes, respectively, which measure domestic flows only. Total minimum flow for the two metering devices was .55 mgd or 41 percent of average daily domestic flow.

These figures do not necessarily contradict the conclusion in the Facilities Plan that there is no infiltration due to groundwater. In Gering as well as in Scottsbluff and Terrytown, the sources of this constant, 24-hour flow may come from non-groundwater sources. The fact that these flows are substantial, however, would indicate that a survey to determine their source or sources is appropriate.

The possibility of significant sources of inflow is discounted in the Gering draft Facilities Plan. Examination of available flow metering charts for one of the domestic sewer meters supports this conclusion as no unusually high peak flows are recorded in several months of data. However, as discussed above, both major meat processing plants in Gering discharge cooling water to their sanitary sewers. Replumbing of cooling water discharge pipes and disposal of the spent cooling water in storm drains would reduce present and future wasteflow estimates by .33 mgd. No reduction in BOD, suspended solids or nitrogen would be anticipated from this diversion.

Terrytown - Similar analysis and conclusions were presented in the draft Facilities Plan for Terrytown as were presented for Gering. Data presented indicate that the average minimum flow for the four-day sampling period was .05 mgd or 28 percent of the average daily flow. While this is a substantial percentage, the actual flow involved is small and does not warrant further concern. A cursory field survey of the sewer system may, however, identify readily rehabilitatable sources of clear-water flow.

Appendix J

Design Criteria and Assumptions for Upgrading the Scottsbluff Lagoon System

Nebraska DEC Design Criteria

Nebraska requires an upper limit of BOD loading of 0.15 lb BOD/1000 cu ft per day equivalent to 25 lb BOD/ac. at 5 ft operating depth. Approval has been given to higher loadings on occasion on a case by case basis. The 25 lb/ac. limit specifically applies to passive stabilization ponds where the oxidation process is not assisted by mechanical means. The purpose of the loading requirement is to avoid extended periods of odor during spring when ice cover melts. The 25 lb/ac-day limit does not address the effluent quality obtainable with this loading rate. A review of available literature shows that adequate treatment in cold weather regions is obtained with required BOD loading rates of 20 to 64 lb/ac-day. (Metcalf & Eddy, 1972; Great Lakes-Upper Mississippi River Board of State Sanitary Engineers, 1973). The Nebraska limit is, therefore, conservative, and, as stated above, the rationale for this limit is avoidance of nuisance odor conditions.

Nebraska favors complete retention, meaning no discharge from waste stabilization ponds. For ponds with stream discharge piping arrangements, a minimum of 120 days of storage from the minimum to maximum water levels based upon influent flow is to be provided although sufficient capacity for 150 days storage is recommended. Stabilization lagoon discharge must be controlled discharge with the amount and schedule of discharging dependent on treatment provided. Discharge twice a year, in the spring and fall, is recommended. Nebraska DEC encourages providing retention during periods of algae bloom in July through September.

A pond configuration utilizing series operation if required when there

is to be a discharge. When total pond area is large, total influent flow should be split into parallel systems each of which shall be series operation. Two primary cells in the series are favored followed by one or two smaller polishing ponds.

Effluent Clarification by Dissolved Air Flotation with Chemical Addition -

Because the existing lagoon system in Scottsbluff is not capable of providing more than 40 days storage time at design flows, effluent quality will be maintained in the treatment options discussed here by incorporating dissolved air flotation with chemical additions to remove solids from the lagoon system effluents. A number of other solids removal unit processes were evaluated in terms of solids removal efficiency reliability and cost (capital and operating). A summary of the literature review on this topic is presented in Appendix K. Of the methods evaluated, two offer appreciable cost or reliability advantages: microscreening and dissolved air flotation with chemical addition. The major advantage of microscreening is its low operating cost. The disadvantage of this process is that very small algae and small organic particles as may remain in the effluent during cold weather operation are not effectively removed. Dissolved air flotation with chemical additions has capital costs comparable to microscreening and can be relied on to provide efficient solids removal, but has significantly higher operating costs.

Comparative costing of system and regional alternatives in this report incorporates capital and operating costs for DAF with chemical additions to be conservative.

Flow Configuration

In the three lagoon treatment options for Scottsbluff, the existing 123 acres of lagoons will be retained as passive stabilization lagoons. The flow configuration recommended for these three options are the same.

Features include:

- ° Parallel distribution of influent wastewater to the first four lagoons.
- ° Interception of effluents from the four lagoons for series flow through lagoons 5 and 6
- ° Provision for draining one of the first four lagoons at a time for periodic removal of sludge

To accomplish the parallel distribution of influent wastewater to the first four lagoons it is proposed to use a concrete lined trapezoidal ditch. This open channel method of flow distribution with flow to individual cells controlled by weirs should provide proper distribution of influent to individual cells and avoid solids accumulation at the head of the system which now occurs. The concrete lined trapezoidal ditch was selected as it has proved to be an effective means of distributing flows in irrigation systems (US-EPA, 1975b).

The theoretical basis for the 4-1-1 lagoon flow configuration is found in State of Missouri Department of Natural Resources guidelines (Missouri DNR, personal communication) for stabilization lagoon design. Under the Missouri guidelines the primary lagoon would contain six-tenths of the total lagoons acreage. Two subsequent lagoons would be sized at three-tenth and one-tenth of the total lagoon acreage. The proposed lagoon configuration approximates this formula as shown below:

<u>Missouri Formula</u>		<u>Scottsbluff - 3' depth</u>	
Primary	73.8 acres	Lagoons 1 through 4 -	89.4
Secondary -	36.9	Lagoon 5	22.5
Final -	12.3	Lagoon 6	11.3
	<u>123.0</u>		<u>123.2</u>

BOD Loading Rates and Aerated Lagoon Efficiency

Design year organic waste loads on the existing lagoon acreage for four industrial pretreatment options, both with and without an initial aeration basin are presented in Table J-1. A BOD removal of 60 percent is assumed for the initial aerated lagoon. This efficiency is lower than that estimated for this type of unit in the August, 1975 Facilities Plan. The 60 percent assumption reflects operating experience described in the literature for high strength wastes (EPA Technology Transfer, 1973).

It can be seen from the data in Table J-1 that initial treatment of wastes in an aerated lagoon will be necessary if the state standard of 25 lbs/acre-day for loading of aerobic lagoons is to be met. Industrial pretreatment by screening or by screening and DAF results in a slight loading advantage. Considering that screening alone will not remove substantial amounts of oil and grease from Flannery Foods wastes, this pretreatment process used without DAF was not considered any further. The addition of the domestic waste from Terrytown to the lagoon system results in an approximate increase in loading of only one pound per acre per day if initial treatment in an aerated lagoon is incorporated into the lagoon design.

The treatment of influent to the municipal treatment system in an aerated lagoon is designed on the basis of a detention time of 10 days and an operating depth of 12 feet. The necessary acreage for the alternatives and the horsepower requirements are also shown in Table J-2. Horsepower requirements were calculated on the basis of complete mixing. A diffused

Table J-1 - Stabilization Pond Loading
(based on 123 Ac.)

Flow = 3.22 for Scottsbluff
3.47 for Scottsbluff #
Terrytown

	waste load BOD-lb/day	LOADING (lbs-BOD/Acre-day)		det = $\frac{\text{Vol.}}{\text{Flow}}$	storage =	vol. between 2' & 5' levels Flow
		Aerobic Only	w/aerated			
No Pretreatment						
Scotts	8464	68.8	27.5	37.6 days	same as detention	
Scotts & Terrytn	8834	71.8	28.7	34.9	" "	" "
Screening						
Scotts	7785	63.3	25.3	37.6	" "	" "
Scotts & Terrytn	8155	66.3	26.5	34.9	" "	" "
Screen & DAF						
Scotts	7016	57.0	22.8	37.6	" "	" "
Scotts & Terrytn	7386	60.0	24.0	34.9	" "	" "
Max Pretreat.						
Scotts	4392	35.7	14.3	37.6	" "	" "
Scotts & Terrytn	4762	38.7	15.5	34.9	" "	" "

Table J-2- Design Factors for Upgrading Existing Scottsbluff Treatment Facilities

Industrial Pretreatment	Waste Load	Municipal Treatment		Stabilization Pond
		Prelim. Treatment	Aerated Lagoon	
No Pretreatment	Flow = 3.22 MGD BOD = 8500 lbs/day TSS = 9600 lbs/day	Screening and DAF	det. time = 10 days depth = 12 ft. area = 8.25 acres vol. 32.2 MG HP = 253 HP	loading = 23 lbs BOD/acre-day area = 123 acres depth = 3 ft det. time = 38 days
Screening and DAF	Flow = 3.22 MGD BOD = 7000 lbs/day TSS = 6300 lbs/day	None	Same as Option #2	Same as Option 2
Max. Pretreat. (Screening & DAF; Anaer.)	Flow = 3.22 MGD BOD = 4400 lbs/day TSS = 5000 lbs/day	None	None	loading = 36 lbs BOD/acre-day area = 123 acres depth = 3 ft det. time = 38 days

air system would be used in the aerated lagoon because of its operational advantages in winter months over mechanical systems. Acreage required is 8.25 acres for Scottsbluff alone and 8.89 acres is the waste flow from Terrytown is routed to the lagoon system.

The previous calculations of BOD loading on the existing 123 acre lagoon system is predicated on the fact that an additional 10-15 acres of land adjacent to the site will be available for locating the aerated lagoon. If such land is not available and the first lagoon must be converted, Table J-3 shows the resulting BOD loadings on the remaining 100 acres of lagoon surface. The loadings are proportionately higher.

The increase in retention time gained by a 70% elimination of infiltration was also investigated. For Scottsbluff, decreasing the infiltration from 0.55 to .17 MGD results in an increase in retention time and storage of approximately five days. As the BOD loading is not decreased, no significant improvement in treatment removal will likely occur by this reduction in flow volume.

Of the eight pretreatment/aeration combinations, three are considered satisfactory for further consideration. Design parameters for these three combinations are presented in Table J-2.

Since no pretreatment is the least cost alternative from the industrial standpoint, this option is retained with the stipulation that the combined wastes will undergo preliminary treatment of screening and DAF at the municipal facility prior to aeration lagoon treatment.

The pretreatment alternative labeled "max. pretreatment" needs further explanation. The option involves requiring the industry to provide pretreatment of the meat packing wastes aimed at high levels of BOD and TSS removal. A description of such an option utilizing anaerobic lagoon treatment has been previously described. Tables J1 and J2 show that limiting the industrial waste

Table J-3 - Stabilization Pond Loading
(based on 100 Ac.)

	Design Waste load (BOD-lbs/day)	LOADING (lbs-BOD/Acre-day)	
		Aerobic only	w/aerated
No Pretreatment			
Scotts	8464	84.6	33.9
Scotts & Terrytn	8834	88.3	35.3
Screening			
Scotts	7785	77.9	31.1
Scotts & Terrytn	8155	81.6	32.6
Screen & DAF			
Scotts	7016	70.2	28.1
Scotts & Terrytn	7386	73.9	29.5
Max Pretreat.			
Scotts	4392	43.9	17.6
Scotts & Terrytn	4762	47.6	19.1



load to 450 lbs BOD/day, equivalent to 90% removal, results in a combined municipal/industrial loading over the existing 123 acres of stabilization ponds of 36 lbs BOD/acre-day. The feasibility of this option rests with the tradeoff between acceptable stabilization pond loading and the ability of the industry to meet the corresponding BOD removal efficiency. The particular option proposed here is felt to be reasonable in that this degree of removal has been achieved in treating meat packing wastes, and higher stabilization pond loading (36 lb BOD/ac-day) are compensated for by the addition of an algae-solids removal process prior to discharge.

Appendix K

Literature Review of Methods for Suspended Solids Removal
from Lagoon Effluents

WAPORA, Inc considered several alternatives in its lagoon upgrading scheme which involved removal of algae and other suspended solids as a final operation prior to discharge. Successful employment of such an operation would considerably reduce both the suspended solids concentration in the effluent and the potentially large oxygen demand imposed upon the receiving stream by the algae's ultimate destruction. Results of several studies indicate an average oxygen demand of 1.19 mg. O_2 required for the oxidation of each milligram of algae.¹

Impending effluent standards deadlines established by P.L. 92-500 have resulted in a relatively large amount of recent literature on this subject, pertaining mainly to laboratory studies and pilot plants. However, the state of the art of algae removal is still in its infancy; and operation and performance data for "in-field" treatment units are quite scarce and not entirely conclusive. The different techniques investigated, along with pertinent comments, are as follows:

1. Intermittent Sand Filtration: This has been field demonstrated to be an effective algae removal technique;² however, the large filter bed areas required for the range of flows considered in this study and the regularly required sand bed scraping and cleaning have led to the conclusion that this is not a feasible alternative.

2. Dissolved Air Flotation without chemical addition: Studies indicate that this technique does not result in substantial removal of algae. For the anticipated suspended solids concentration considered in this study, air flotation alone, even with optimal recycle, could be expected to produce only a 33 percent removal.³

3. Dissolved air Flotation with Chemical Addition: Recent studies indicate that this process, floatation in conjunction with coagulation and recycle, can be a very effective algae removal technique⁴. The major disadvantages discussed were a relatively high cost and, because of the coagulant added, a significant increase in the bulk of sludge to be removed and dewatered.

4. Submerged Rock Filtration: The very limited information available on this subject shows promise of an effective and essentially maintenance free algae removal technique.⁵ Its practical use however seems restricted to smaller flows than those considered in this study, and its untested nature does not lend itself to confidence in a full scale application.

5. Microstraining: This operation has been effectively used for algae removal from public water supplies. It's low cost and minimum operation and maintenance requirements are obvious advantages. Indications are however that the smaller sized algae generally associated with sewage lagoons (chlorella) will readily pass through the smallest pore size,⁶ and an optimistic removal efficiency may be only 50%.

6. Multimedia Filtration without Chemical Addition: Available literature indicates that this technique has not proven very successful in the treatment of algae laden waters.⁷ Direct filtration has resulted in relatively poor removals of suspended solids and short filter-run lengths.

7. Multimedia Filtration with Chemical Addition: This operation has been successfully applied in suspended solids removal on lagoon effluents,⁸ however its specific application in regards to algae removal has yet to be fully demonstrated. The advantages are its automatic operation and minimal maintenance costs.

8. Chemical Coagulation and Sedimentation: As with Chemical coagulation and flotation, this process has been established as workable and dependable for algae removal. Indications are, however, that flotation is economically superior to sedimentation because higher overflow and lower residence times can be used, equivalent removals can be obtained for approximately the same chemical dose, and greater sludge concentration is attained.⁹

Of these alternatives, three were selected for closer scrutiny on the basis of some apparent advantage in the areas of cost, reliability, or simplicity. These are:

Microstrainers

Multimedia Filters with chemical coagulation

Dissolved Air Flotation with chemical coagulation

Detailed cost estimates for these processes were developed for flows of 3.2 mgd and 5.6 mgd. These estimates, summarized in Table P-1, show that multi-media pressure filtration does not offer either cost or performance advantages over dissolved air flotation with chemical additions. Microstrainers, because their performance is dependent on the size of algae in the effluent, are less reliable than dissolved air flotation but offer a significant advantage in operating costs. Sludge volumes generated by microstrainers would also be less than DAF for any given solids removal efficiency. Labor costs could also be lower because of the lack of materials handling costs.

Because of its assured reliability, dissolved air flotation with chemical addition is included in all stream discharge alternatives as the effluent solids removal process.

1. Friedman, et al., "Algae separation from oxidation pond effluents."
Journal WPCF, Vol. 49, No. 1, Jan 1977.
2. Harris, Reynolds, et al., "Intermittant sand filtration for upgrading
waste stabilization pond Effluents", Journal WPCF, Vol. 49, No 1., Jan
1977.
3. Bare, Jones, Middlebrooks, "Algae Removal using Dissolved Air Flootation,"
Journal WPCF, Vol. 47, No. 1., Jan 1975..
4. ibid.
5. Obrien, et al., "Two Methods for Algae Removal," Water and Sewage Works,
March, 1973.
6. Parker, et al., "Discussion, Techniques for Algae Removal from Oxidation
Ponds." Journal WPCF, Vol. 47, No. 9, Sept 1975.
7. ibid.
8. Myers, et al., "Chemical Coagulation/Mixed media Filtration of Aerated
Lagoon Effluent." EPA Builetin 660/2-75-025, Environmental Protection
Technology series. June, 1975.
9. Environmental Protection Agency, Technology Transfer Publication,
"Upgrading Lagoons," August 1973.

Table K-1

Cost Summary of Selected Solids Removal Processes

	3.2 MGD Plant			5.6 MGD Plant			Expected Performance
	Capital Costs	Total Yearly Costs	Cost Per Thousand Gallons	Capital Costs	Total Yearly Costs	Cost Per Thousand Gallons	
Microstrainer	152,000	16,100	0.014	304,000	32,000	0.016	Very questionable reliability
Dissolved Air Flotation with Chemical Coagulation	184,000	46,400	0.040	308,000	79,600	0.038	Reliable
Multi-media Pressure Filters with Chemical Coagulation	207,000	47,500	0.041	335,000	75,600	0.037	Questionable reliability

Note: Costs do not include operator personnel costs nor sludge disposal costs.

Appendix L

Design Criteria and Assumptions for Upgrading the Gering Lagoon System

The Need for Oil and Grease Removal

Oil and grease from Swift Co. and Stanko Packing accumulate on the existing anaerobic lagoons to the extent that the scum layers must be burned off periodically. This unusual operating problem can be avoided by removing oil and grease from the industrial wastewaters. The most reliable method of removing oil and grease is dissolved air flotation preceded by fine screening. If the air pollution and nuisance problems are considered to be severe enough to warrant positive action, two alternative approaches to locating the screening and DAF facilities would be to treat the combined Swift and Stanko wastewater at a site adjacent to the existing pump station or at the industrial plants. Municipal treatment of the combined wastewaters could provide the monetary advantage to the industries of economy of scale. However, part of the combined industrial wastewater would be sanitary wastes from the plants. The presence of the sanitary wastes could preclude the plants from reuse of the screening or DAF sludges by rendering, thereby possibly eliminating any economy of scale advantages to industry. Siting the pretreatment facilities at the meat packing plants would permit exclusion of sanitary wastes from the sludges, insuring that they could be reused.

Anaerobic-Aerated-Aerobic Lagoon Treatment for Meat Packing Wastes

The use of an anaerobic-aerated-aerobic lagoon system for the treatment of meat packing wastes has been found to provide adequate treatment by the industry. Design considerations here involve upgrading the system to meet design flows and loadings.

to be controlled so as to assure sealing of the anaerobic lagoons without allowing excessive scum accumulation.

Domestic Waste Treatment

As to the treatment of domestic wastes, the February, 1977 Gering Facilities Plan assumed that a new, 40-acre stabilization lagoon would be utilized for this purpose. Considering that, at State loading limitations, a 40-acre stabilization lagoon would be allowed to receive only 1000 lbs BOD per day of the 2,515 lbs projected (includes domestic, Lockwood Corporation and future industrial growth), this proposed design has been reevaluated and alternatives to a new stabilization lagoon have been investigated.

Assuming that the 500 lbs BOD per day projection for future industrial growth is discharged to the domestic sewers, the total projected BOD load for any domestic wastewater treatment facility would be 2,515 lbs BOD per day. At the recommended design loading of 25 lbs BOD per acre-day, 100 acres of new lagoon would be required. Two 30-acre lagoons operated in parallel would receive the raw domestic wastes and would discharge to a third 30-acre lagoon, which would discharge in turn to a 10-acre lagoon.

Alternatively, the same approach could be taken in Gering as has been considered for upgrading the existing lagoon system in Scottsbluff: providing an aerated lagoon to achieve significant BOD reduction followed by use of the existing lagoons #1B and #2 to complete secondary treatment. The aerated lagoon volume required to provide 10-day retention time at the domestic sewage design flow of 1.6 mgd is equivalent to 16.0 million gallons or 49 acre-feet. At a twelve-foot operation depth, 4.1 acres (5 acres including dikes) of space would required for this new aerated lagoon. This

space could be provided on adjacent land owned by the City of Gering. Because the domestic sewage tributary to this aerated lagoon would not be expected to be particularly strong, a 75 percent reduction in BOD is assumed. At design loading of 2,515 lbs BOD per acre-day, the BOD load on Lagoons #1B and #2 would be 25 lbs BOD per acre-day if they all were constructed on adjoining land and 31.5 lbs BOD per acre-day if 5 acres of lagoon #1B were taken for the aerated lagoon.

In regard to final treatment of lagoon effluents prior to stream discharge, the same considerations of solids removal apply to the Gering industrial and domestic effluents as were reviewed above for the Scottsbluff lagoon effluent. Unavailability of 120 day storage volume in the existing Gering lagoon systems should not preclude continued use of those facilities. The Nebraska design standards do not speak to the possibility of eliminating the storage requirement. But considering that effluent quality is the basis for the storage requirement and that DAF can be expected to produce acceptable effluent quality, it would not be appropriate to include both solids removal and 120 day storage capacity in alternative design. Because solids removal processes can be added without significant taking or disruption of new land and because they offer a more positive means of controlling effluent quality, providing additional lagoon acreage for seasonal storage is eliminated from Gering's wastewater treatment options in favor of effluent solids removal. It is assumed that both industrial and domestic lagoon effluents will be combined prior to the solids removal unit. As in Scottsbluff, DAF with chemical addition is considered in alternatives costing to be conservative, but microscreening could possibly produce acceptable results.

A summary of design criteria for the wastewater treatment process options required prior to stream discharge of Gering's effluents is presented in Table L-1. These four options all assume solids removal from the effluent prior to discharge.



Table L-1.

Design Factors in Upgrading Gering's Existing Lagoon System

Municipal Treatment			
	Industrial Waste Load Pretreat.	Preliminary Treatment	
Option #1	No* Pre-treatment <u>IND</u> 0.78 MGD BOD-9400 lbs/day TSS-11800 lbs/day <u>DOM</u> 1.6 MGD BOD-2500 lbs/day TSS-2900 lbs/day	Screening & DAF Screening & DAF	Aerated Lagoons Existing Aerated Existing Anaerobic Existing Aerated Stabilization Pond(s) Existing ponds #1A, #1B, and #2 DOM New Stabilization Pond loading - 25 lb BOD/acre-dry depth - 3 ft area - 100 acres det. time - 38 days (120 total)
Option #2	No* Pre-treatment Same as Option #1	Screening & DAF	Aerated Lagoons Existing Aerated Existing Anaerobic Existing Aerated Stabilization Pond Existing Pond #1A det. time = 10 days, vol = 7.8 MG, depth = 12 ft, H.P. = 59 HP area area = 2 AC. DOM Aerated Lagoons det time = 10 days depth = 12 ft area = 4.1 acres (5 total) Stabilization Ponds Existing Ponds #1B and #2
Option #3	Screening and DAF <u>IND</u> 0.78 MGD BOD-6400 lbs/day TSS-4100 lbs/day <u>DOM</u> 1.6 MGD BOD-2500 lbs/day TSS-2900 lbs/day	None	Same Treatment as Option #1 Same Treatment as Option #1
Option #4	Screening and DAF Same as Option #3	None	Same Treatment as Option #2 Same Treatment as Option #2

*Because of significant disposal problems with oil and grease on the anaerobic industrial lagoons some form of oil and grease removal is necessary. Alternative #1 and #2 assume this step will be provided by the City.

Appendix M

Recommended Upgrading Techniques for Terrytown's Extended Aeration Wastewater Treatment Plant

The existing treatment plant serving the village of Terrytown consists of the following; a dual pump lift station employing on-off control pumps the wastewater to a splitter box which discharges in parallel to two aerated basins. Return waste activated sludge is discharged into the splitter box also. The wastewater passes through the twin basins, one discharging to the east end and the other to the west end of a rectangular clarifier. Sludge is carried only to the west end of the clarifier where two air lift pumps recycle it to the splitter box at the inlet end of the aerated basins. The effluent discharges to a center launder from which it flows by gravity to the North Platte River. A scum baffle and small air lift pump, located at each inlet end of the clarifier returns floating material to the aerated basins. The air required for operation of the air diffusers in the aerated basin, the sludge and scum recycle air lift pumps are provided by 3 air blowers. The influent is measured through a 3" parshall flume and a recently installed monthly strip chart flow recorder.

There are a number of operating and other problems associated with this facility:

1. The splitter box at the inlet of the parallel aerated basins distributes the recycle sludge relatively equally to each basin when the effluent lift pumps are not operating. When these pumps operate the flow pattern through the splitter box is unequal and nearly all the recycle sludge flows into the west aeration basin.

2. The major control for distributing air to the basins is achieved by

turning a blower on or off. Thus there is no way of controlling the amount of air in either basin independently of the other basin.

3. The center discharge launder in the rectangular clarified is designed to provide a means for draining the entire treatment plant if the need should arise. For this purpose there is a 12" wide compartment between the two discharge launders. The launders receive the flow from the two aerated basins independently. Each launder is attached to the verticle walls that create the 12 inch wide compartment located between the launders. This compartment is hydraulically connected to the aerated basins because the water level in the compartment is at the level maintained in the basins which is higher than the water level in the clarifier. The top of the walls of this compartment is nearly equal to the water level in the aerated basins. The liquid in this compartment which is filled with mixed liquor solids, slops over the compartment walls and falls into the discharge launders. Thus the effluent from the treatment contains quantities of mixed liquor solids.

The effluent quality reported from a once a week 24 hour composite sample, shows that the effluent quality is periodically in compliance with discharge limitations even with the contamination described above. By raising the sides of the center compartment or lowering the water level in the aerated basins, contamination of the effluent can be reduced. Then the plant would probably meet discharge limitation regulations. However, for projected waste loads the following modifications would probably be required. This of course can only be determined after correcting the condition described above. However, evaluation of the information obtained from on-site visits indicates that the following modifications to the existing facilities would produce an effluent in compliance with discharge limitations.

These are:

1. Eliminate parallel flow in the aeration basins and dual flow in the clarifiers.
2. Remove and replace the center launder discharge in the clarifier, including the compartment that is connected to the aerated basin.
3. Provide means for the treatment and disposal of excess activated sludge. (This is discussed in Section III.B. 6).

The modifications required to achieve the flow changes described above are relatively simple.

1. Reroute the inlet pipe to discharge all flow into the northwest corner of the west aeration basin. Provide overflow from the west to the east basin.
2. Reroute the sludge recycle pipes to discharge to the northwest corner of the west basin.
3. Plug inlet to northwest end of clarifiers so that flow will enter clarifier only at the east end. Provide discharge launder and scum baffle at the west end of the clarifier.
4. Remove center launder and the compartment now connected to the aeration basin.
5. Provide flow metering valve on discharge pipe from east aeration basin to east end of clarifier. This valve would provide nearly constant discharge to the clarifier thus using the aeration basins to provide flow equalization.

The above modifications should upgrade the present facility to meet discharge limitations for the projected waste load.

Appendix N

Agricultural Management Practices for Irrigation Alternatives

The agricultural management practices employed at irrigation sites would be critical to the success of effluent disposal by this method of effluent disposal. Success would be measured by long term productivity of the irrigation plots, sales values of the crop and avoidance or mitigation of adverse environmental impacts. A number of management practices will influence overall success, especially selection of crops, providing adequate water supply and drainage, prevention of excessive soil erosion and periodic monitoring of crop and environmental results.

Crop Selection - Crop selection is limited in this case to those which are tolerant to both high total dissolved solids and high boron concentrations in the irrigation water. As discussed earlier the total dissolved solids concentration in the irrigation water will range from 1300 ppm to 1600 ppm dependant upon season and regionalization of wastewater management. The electroconductivities associated with these values are 2000 to 2500 micromhos/cm. Based upon limited sampling data in Scottsbluff and Gering the boron concentration will range from 1.2 ppm to 1.7 ppm. Another important consideration in crop selection is nitrogen uptake rate of the selected crop since nitrogen loading by the irrigation water (expressed in pounds of nitrogen per acre per year) should not exceed the annual nitrogen crop uptake. The nitrogen loading is a design factor in sizing the irrigation plots and is incorporated to minimize nitrate leaching into ground water.

The total dissolved solid (salt) tolerance, boron tolerance, annual water requirement and nitrogen uptake rate of various crops are listed in Table L-1. With the exception of reed canary grass which was considered in

Table N-1
Crop Parameters Used in Crop Selection

Crop	Salt Tolerance ^a (ECe-10%)	Boron Tolerance ^e	Nitrogen Uptake (lb/ac/yr)	Annual Consumptive Water Use ⁱ (inches)	Yield per Acre ^j (units/yr)	Unit Price ^k (\$/unit)	Crop Worth (\$/ac/yr)
Coastal Bermuda Grass	13		480-600 ^f				
Barley	12 ^b	Semi-tolerant	60 ^g	17.7	37.0 bu	2.33	\$86
Sugar Beet	10 ^b	Tolerant	200 ^h	30.8	18.6 tons	19.80	368
Tall Fescue	7		275 ^{g,h}			57.70	
Wheat	7 ^b	Semi-tolerant	50-76 ^{f,h}	17.7	47.0 bu	2.89	136
Sorghum	6			19.6	50.0 bu	2.11	106
Oats	7 ^c	Semi-tolerant	74 ^g	17.7	47.0 bu	1.53	72
Soybeans	5.5		99-113 ^{g,h}	12.8	25.6 bu ^k	6.71	172
Corn (Field)	5	Semi-tolerant	155 ^{f,h}	24.5	85.0 bu	2.37	201
Beardless Wild Rye	4		60-70 ^g	17.7	22.0 bu	2.48	55
Alfalfa	3	Tolerant	155-220 ^{f,h}	30.6	3.5 tons	57.70	202
Reed Canary Grass	2.5 ^d		226-359 ^{f,h}			57.20	
Clover	2		77-126 ^f		148 tons	57.70	85
Dry Edible Beans	1.5			17.8	11.59/100 wt ^k	15.25/100 wt.	

^a (Ayres, 1973) as quoted in (EPA, 1975). Salt tolerance is expressed as the electro-conductivity in millimhos per centimeter (mmho/cm) of soil saturation extract that will cause an expected crop yield reduction of 10 percent (ECe-10%)

^b Tolerance during germination (beets) or early seedling stage (wheat, barley) is limited to ECe of about 4 mmho/cm (EPA, 1975)

Table N-1- Cont'd.

- c Assumed to be the same as wheat, EPA (1975b) presents no data on oats but Van den Berg (1950) ranks the salt tolerance of oats only slightly below that of wheat.
- d Specific data not available. Van den Berg (1950) ranks reed canary grass below orchard grass which has an ECe-10% of 2.5.
- e According to Eaton (1935) as reported in (USDA, 1954)
- f EPA, 1975
- g Fried and Broeshart, 1967
- h Nebraska DEC, undated.
- i Soil Conservation Service, 1972.
- j 1975 yields for irrigated crops in Scottsbluff County from (Nebraska Dept. Agr., 1976) except soybeans, clover and dry edible beans.
- k December 1976 prices paid to farmers nationwide. Personal communication, Don Mellon, Statistical Reporting Service, U.S.D.A., April, 1977.

the Scottsbluff and Gering 201 Facilities Plans and several other forage crops, the list of crops in Table k-1 is limited to those which presently have developed markets in Scottsbluff County. Expected crop yield with good soils and proper management, unit price of the crop and worth of the crop per acre are also listed for subsequent economic evaluation of irrigation alternatives.

Water Management for Agricultural Irrigation - Selection of irrigation method, design of the plot and water distribution and operating practices should seek to achieve the most uniform distribution of applied irrigation water and of leached water as possible. Uneven rates of application or of leaching through the soil profile can result in areas where salt accumulation reduces plant growth and yield. Increasing salinity of water in the root zone of crops increases the total soil-moisture stress that plants must overcome to acquire sufficient water for plant development and growth. Concentration of salts in the soil solution is increased by evaporation and transpiration. Quantities of salt can be supplied either in irrigation water or by the upward movement of shallow (5-6 feet) groundwater in response to drying out of surface soils. Soluble salts increase or decrease in the root zone, depending on whether the net downward movement of salt is less or greater than the net salt input from irrigation water and other sources.

Because of the high dissolved solids content of the treated wastewaters in the study area, development of wastewater management alternatives incorporating land application as an effluent disposal method must include adequate provisions for control of salt accumulation in the irrigated plot. The three stages of irrigation water management, i.e., irrigation, leaching, and drainage, are considered here with the intent of developing

irrigation alternatives with the greatest potential for controlling salt accumulation.

Irrigation - Two irrigation methods are commonly used in Scottsbluff County: ridge and furrow irrigation and spray irrigation by center pivot. A third, less commonly used method, irrigation by flooding, may have utility because of its potential for positive control of soil salinity.

Ridge and furrow irrigation is well adapted to cultivation of row crops. Because leaching occurs primarily in the furrows, there is a tendency for salt to accumulate in the ridges. The use of wide-bottomed furrows, plowing and mixing of the surface soil, and rotation of crops along with a change to irrigation by flooding can mitigate or reverse salt accumulation that may occur. As a safety factor, it should be stipulated that any design for ridge and furrow irrigation include the feasibility of temporarily converting to irrigation by flooding. This would limit ridge and furrow irrigation proposals to relatively level areas or areas that can be terraced economically. Ridge and furrow irrigation suffers somewhat from the environmental problems related to excess surface-water runoff when water distribution is not uniform or when too much water is applied..

Spray irrigation by center pivot was proposed as the irrigation method in the Scottsbluff and Gering Facilities Plans. Other types of sprinkler systems are available including various stationary and continuously various mechanical sprinkler designs. If alternatives incorporating spray irrigation for treated effluent disposal are found to be most cost-effective, consideration to other sprinkler designs should be given during preparation of detailed design in Step II of the construction grants process. Spray irrigation, although often more costly than other irrigation methods, allows precise control of applied water depth and distribution. It is not limited

to relatively level topography. Spray irrigation by center pivot suffers somewhat on the basis of land utilization efficiency when compared to other spray irrigation designs because the corners of irrigation plots are not easily covered. Nevertheless, common acceptance and usage of spray irrigation in the study area is a good indication that the economies of this design are favorable in comparison with others. Because of this and because detailed cost data from the center pivot design are available, spray irrigation design options will be limited to center pivot in the present study.

Irrigation by flooding provides optimum control over salt accumulation. Variants of this method are differentiated by the amount of bordering required. Wild flooding uses no borders to control flow, is useful only in level areas and is practiced primarily with pastures, alfalfa and small grains. Border-check flooding uses borders to control the flow of water flooded over the ground surface and down the slope in the direction of the borders. Border-check flooding can be used where there is appreciable slopes. It is used with alfalfa, small grains and in orchards. Distribution of water and, therefore, of salt accumulation is not as well controlled by this method as by wild flooding and basin flooding. Basin flooding provides the best control of water distribution and can be adapted to moderate slopes where borders are constructed to follow contours at small elevation intervals. Only crops which can tolerate periodic flooding are adaptable to this method of irrigation.

Cost comparison of the various irrigation methods show that the ridge and furrow method is less expensive than spray irrigation. While no local data on flooding methods is available, it is estimated that these costs would be similar to those for ridge and furrow irrigation. It is proposed here that use of ridge and furrow irrigation be limited to areas with relatively

level topography so that periodic flooding can be used as a positive control for salt accumulation. Other factors (such as environmental impacts) being equal, ridge and furrow irrigation would be preferred to spray irrigation at sites with relatively level topography. Spray irrigation would be the method of choice where topographic conditions prevent periodic flooding in conjunction with ridge and furrow. Flooding is considered here only as a salinity control method for ridge and furrow irrigation since insufficient data on the local market and agricultural practices of various suitable crops is available.

Leaching - Regardless of the irrigation method used, the high dissolved solids content of the irrigation water in conjunction with crop sensitivity to salt concentrations in the soil water require that excess salt be removed from the root zone. This same principle applies to conservative toxic substances such as boron which may be present in the irrigation water. Depending upon the crop and the soil moisture maintained, some dissolved solids may be removed from the soil water by crop uptake and by chemical precipitation. Methods for calculating the leaching requirement generally discount these processes because of the many unquantifiable factors involved and because they typically are capable of removing a relatively small portion of the dissolved solids added by high salinity irrigation water.

The "leaching requirement" is the fraction of the applied irrigation water that must be leached through the root zone to control soil salinity at a specified level. The level at which soil salinity must be controlled is dependant upon crop sensitivity to the total dissolved solids (salt) content of the soil water. These levels for various crops are listed in Table in terms of electrical conductivity, which is linearly related to total dissolved solids. The values given are those which cause a 10 percent decrease in expected yield. Actual protection levels will depend on

climate conditions and crop varieties actually grown.

In order to substantiate preliminary design configurations for the land requirements of irrigation alternatives, the total hydraulic loading rate and the leaching requirement for various salt-tolerant crops was calculated using the following formulas:

$$EC_{iw} = \frac{D_{rw} EC_{rw} + D_{Iw} EC_{Iw}}{D_{rw} + D_{Iw}} \quad (1)$$

where: D_{rw} = average annual rainfall in inches

EC_{rw} = electroconductivity of rainwater in millimhos per centimeter (mmho/cm)

D_{Iw} = irrigation water supplied from sources other than rainwater in inches

EC_{Iw} = electroconductivity of irrigation water supplied from sources other than rainwater in mmho/cm.

EC_{iw} = electro conductivity of total waters applied to irrigation plots in mmho/cm. Referred to simply as "irrigation water" hereafter.

$$D_{iw} = \left(\frac{EC_{dw}}{EC_{dw} - EC_{iw}} \right) D_{cw} \quad (2)$$

where: D_{iw} = depth of irrigation water (including rainfall) applied per year in inches

EC_{dw} = electroconductivity of drainage water in mmho/cm. This is taken to be equivalent to the EC_e of other references (EPA, 1975) which is the electroconductivity of the soil-water saturation extract in mmho/cm. The value of this parameter used is the electroconductivity of soil-water extracts causing a 10 percent reduction in crop yield (see Table).

EC_{iw} = as calculated in Equation 1.

D_{cw} = annual consumption use of water by the crop in inches

$$LR = \frac{D_{dw}}{D_{iw}} = \frac{EC_{iw}}{EC_{dw}} \quad (3)$$

where: LR = Leaching Requirement

D_{dw} = depth of water leached through the soil profile in inches.

Applying these equations with relevant crop statistics from Table the leaching requirement, LR, depth of total annual irrigation water, D_{iw} , and depth of treated effluent irrigation water, D_{Iw} , for various crops were calculated and are listed in Table L-2. These values are used here to estimate hydraulic loading rates in irrigation plot design and to provide a quantitative basis for predicting impacts of land application of treated effluents on groundwater. These estimates are valid subject to the assumptions that irrigation water will be uniformly distributed, and that the soils used will provide adequate drainage throughout the soil profile. The estimates are based on data for long-term averages of total dissolved solids and irrigation water flow based upon available sampling data (TDS concentrations), projection of the future conditions (wastewater flows), and calculation of evaporative concentration of TDS discussed in Appendix M.

Drainage - Control of soil-water salinity requires that soils used for irrigation be well drained. Also, because of potential increases in water table elevation by the leaching water, it is desirable that existing water table elevations be sufficiently deep under the ground surface to preclude surface seepage or return of leached solids to the surface soil.

As discussed in the "Geology and Soils" section of the environmental inventory, significant acreage of well-drained soils are present in the study area. Detailed, specific soil studies must

Table N-2

Irrigation Requirements for Selected Crops Showing the Effects of Salt Tolerance (EC_{dw}) on Leaching Rates, and Depths of Irrigation and Drainage Water

	Growing Season	Consumptive Water Use (in)	Growing Season Rainfall (in)	EC _{dw}	Leaching Rate	Depth of Irrigation Water (in)	Depth of Drainage Water (in)
Sugar beets	Apr-Oct.	30.8	12.37	10	.156	24	5.7
Wheat	Apr-July	17.7	9.45	7	.19	12	4.1
Corn	May-Oct.	24.5	10.85	5	.333	26	12.3
Alfalfa	Apr-Sept.	30.6	11.55	3	>.66	Not	Feasible

N-10

NOTE: Calculations assume average total dissolved solids = 1500 mg/l equivalent to electroconductivity = 2.34 mmhos/cm. Actual average salinity above this level would increase the leaching rate (LR), depth of irrigation water (D_{Iw}) and depth of drainage water (D_{Dw}) curvilinearly.

EC_{dw} (electroconductivity of the drainage water) is taken to be equal to the EC_e-10% of the crops as listed in Table

Appendix O

Design of Facilities for Irrigation Alternatives

The methodology and assumptions used in sizing the agricultural irrigation holding pond and estimating the number of acres of irrigation land needed are described here. This section also presents the procedure used to estimate the final concentration of important water quality parameters in the applied irrigation water.

Irrigation Storage Pond and Cropland Requirements

The first step in calculating the size of the storage facility needed for irrigation was to determine waste flows. Table O-1 shows the contributing industrial and domestic waste flows for Scottsbluff, Gering and Terrytown. The magnitude of TDS, nitrogen, and boron waste loads are also shown. The magnitude of wastewater flows for the five regional irrigation alternatives under consideration are presented below.

<u>Irrigation Regional Alternative</u>	<u>Flow (MGD)</u>
Alt. A All three towns	5.85
Alt. B Scottsbluff & Terrytown	3.47
Alt. C Gering & Terrytown	2.63
Alt. D Scottsbluff	3.22
Alt. E Gering	2.38

The approach taken here to estimate the storage requirements for the five alternatives was to first estimate the total required storage capacity for Scottsbluff alone, and to base the required capacity of the other alternatives on the ratio of the total flow of the alternative to that of Scottsbluff. It is felt that this approach is reasonable in that moisture losses in the treatment lagoons and the holding pond and the use of 3 ft. storage available

Table O-1
Waste Sources

Waste	Flow MGD	TDS lbs/day	Nitrogen (TKN) lbs/day	Boron lbs/day
<u>SCOTTSBLUFF</u>				
Domestic	1.98	18,200 ¹	459 ²	--
Flanery Foods	0.40	5,840 ³	319 ³	--
Infiltration	0.55	3,200 ⁵	-0-	--
Future Industries	0.10	-0-	-0-	--
CRA	0.10	1,110	8.2 (NH ₃ only)	--
Total	3.22	28,400 lbs/day 1,060 mg/l	786 lbs/day 29 mg/l	36 lbs/day ⁷ 1.34 mg/l
<u>GERING</u>				
Domestic	1.16	10,600 ¹	242 ²	--
Stanko & Swift	0.78	12,200 ⁴	664 ⁴	--
Lockwood	0.18	1,700 ⁶	-0-	--
Future Industries	0.26	-0-	-0-	--
Total	2.38	24,500 lbs/day 1,235 mg/l	906 lbs/day 46 mg/l	18 lbs/day 0.9 mg/l ⁸
<u>TERRYTOWN</u>				
Domestic	0.25	2,300 ¹ lbs/day 1,100 mg/l	61 lbs/day ² 29 mg/l	2 lbs/day 0.9 mg/l

1. Based on domestic TDS concentration of 1100 mg/l.
2. Based on .025 lbs. TKN per capita per day.
3. Flanery waste load based on 375 LWK.
4. Combined Stanko and Swift based on 780 LWK.
5. Based on average well water TDS concentration of 700 mg/l.
6. Based on 1100 mg/l, as combined with domestic.
7. Scottsbluff lagoon effluent, Aug. 1974 sampling.
8. Gering lagoon effluent, Aug. 4 day sampling 1974.

in the treatment lagoon apply to all of the alternatives.

For Scottsbluff, the monthly net moisture loss in the treatment lagoon was subtracted from the average daily flow over the month to obtain the monthly lagoon effluent volume. The size of the irrigation holding pond was determined so as to provide enough capacity for the seven month period of storage when irrigation water is not being applied. The 120 MG of storage in the Scottsbluff lagoons and a percolation rate of 1/8" per day was included in the calculation. Wet weather conditions (wettest year in 25) was assumed, to provide sufficient storage capacity. Monthly lake evaporation values from the University of Nebraska were used.

The estimated land requirements for the storage facilities and the volume of storage capacity available at a 12 ft. depth for the regional alternatives are shown in Table O-2.

Table O-2

Land Requirements for Irrigation Alternatives

Alternative	Storage Pond			Irrigation		Total Acres
	Storage Volume (mg)	Storage Pond (Acres)	Buffer Acres	Wetted Acres	Buffer Acres	
A All 3 towns	841	214	+30	1922	384	2550
B Scottsbluff + Terrytown	473	121	+30	1129	225	1505
C Gering + Terrytown	410	105	+30	876	175	1186
D Scottsbluff	432	110	+30	1043	208	1391
E Gering	367	94	+30	786	157	1067

Table 0-2 also shows the number of acres of irrigation land, both wetted area and buffer zone, required for the various alternatives. An hydraulic loading rate of 25" per growing season for the design crops plus allowance for a 10% moisture loss in application was used. The hydraulic loading is based on salt tolerance of the crops as noted in Appendix L. Hydraulic loading rates were calculated using salt (total dissolved solids) concentrations calculated as described below. This was done by an iterative process since the result of the hydraulic loading rate analysis is one input for the calculations of salt concentrations and vice versa.

Irrigation Water Quality

To determine the concentrations of total dissolved solids, nitrogen, and boron in the applied irrigation water, one alternative, Scottsbluff alone, and one conservative element, TDS, was first investigated. The monthly input of TDS into the system was added to the hydraulic budget already described.

The concentration of TDS in the applied irrigation water was estimated by determining on a monthly basis the end of the month mixed concentration of the parameter in the storage pond. As noted, the 120 MG storage capacity in the existing stabilization lagoon system was taken into account, and a percolation rate of 1/8" per day in the storage lagoon was assumed. The concentration of applied irrigation water in any month was assumed to be the mixed concentration in the pond at the end of the previous month.

The average concentration of TDS over the 5 month summer irrigation season (June-October) was then taken to be the average irrigation water quality. Concentration factors representing the ratio of the initial concentration of TDS in the wastewater to the final end of month mixed concentration in the storage pond were also determined. The concentration factors, then, averaged over the five month period was used to estimate the

concentration of the two other parameters, nitrogen and boron in the applied irrigation water for Scottsbluff.

TDS and boron were assumed to pass through the system with no losses except through percolation in the holding pond. A 40% reduction in nitrogen in the treatment lagoon was also assumed based on experience at Gering as indicated by lagoon sampling data and similar results reported in the literature.

The concentration factors for the five irrigation months are shown below:

Concentration Factors

<u>Month</u>	<u>Factor*</u>
June	1.22
July	1.22
August	1.32
September	1.47
October	1.19
Average	1.28

* $\left(\frac{\text{Concentration of conservative constituent in raw wastewater}}{\text{Concentration in storage pond at end of month}} \right)$

The concentrations of TDS, nitrogen, and boron in the irrigation pond effluent over the irrigation season for Scottsbluff alone are shown in Table 0-3. The table also lists the initial and final concentration of these elements for the other regional irrigation alternatives. For the other alternatives the same concentration factor was used as for Scottsbluff. The rationale for using the same factor is that the changes in concentration for the other alternatives is due to the same net effect of evaporation percolation and precipitation as for Scottsbluff.

At an hydraulic loading rate of 25" over the growing season, the amount of nitrogen applied to the wetted area, assuming concentrations of nitrogen in the irrigation water shown in Table 0-3 varied from 125 lbs N/acre/yr if wastewater from Scottsbluff alone is used to 204 lbs N/acre/yr if

Table O-3

Concentrations of TDS, Nitrogen and Boron in
Waste Sources and Applied Irrigation Water

Alternative	TDS mg/l	Nitrogen ¹ mg/l	Nitrogen ² mg/l	Boron mg/l
A	(1132) ³	(36)	(31)	(1.15)
All 3 towns	1453	28	24	1.48
B				
Scottsbluff + Terrytown	(1062) 1364	(29) 23	(27) 21	(1.31) 1.68
C				
Gering + Terrytown	(1223) 1570	(44) 34	(36) 28	(0.9) 1.16
D	(1060)	(29)	(27)	(1.34)
Scottsbluff	1361	22	20	1.72
E	(1235)	(46)	(37)	(0.9)
Gering	1586	35	29	1.16

1. Includes 40% removal in treatment lagoon.

2. Includes industrial waste pretreatment consisting of screening & DAF,
plus 40% removal in treatment lagoon.

3. (36) = waste source.

28 = final concentration of irrigation water.

Gering waste alone is applied. This nitrogen loading rate assumes no pre-treatment of industrial wastes. Compared to the nitrogen loading limit of the State of Nebraska for sugar beets of 200 lbs N/acre/yr., all regional alternatives except the use of wastewater from Gering alone have acceptable nitrogen loading rates. However, as the nitrogen loading rate is close to the acceptable limit for the Gering alternative, the irrigation acreage requirement was not adjusted on the basis of the nitrogen uptake rate.

Since the major source of nitrogen in the wastewater flows is industrial waste, the nitrogen loadings were calculated on the basis of assuming

industrial pretreatment which results in the irrigation water nitrogen concentrations also shown in Table O-3. The corresponding loading rates for the alternatives with industrial pretreatment range from 113 to 160 lbs/N/acre/yr., which are within the acceptable limit for either sugar beets or corn.

Estimates of concentrations of boron in the applied irrigation water shown in Table O-3 range from 1.2 to 1.7 mg/l. US-EPA places the criterion for long-term irrigation on sensitive crops, such as citrus, at 0.75 mg/l. However, as the two design crops are sugar beets and corn, additional references were reviewed to determine the amount of boron in irrigation water tolerated by the two crops.

A list of the tolerance of crops classified as sensitive, semi-tolerant, and tolerant was prepared by Scofield (1935) and is presented below. The results of Scofield's work are referenced in recent publications on toxicity of boron in irrigation waters (Sprinkler Irrigation Assoc., 1975; USDA, 1954). According to Scofield the crop groupings are fruit trees (sensitive), vines and cereals (semi-tolerant), and vegetables (tolerant).

Table O-4

Permissible Limits of Boron for Several Classes of Irrigation Waters

<u>Classes of Water</u>	<u>Sensitive Crops</u>	<u>Semi-tolerant Crops</u>	<u>Tolerant Crops</u>
	ppm	ppm	ppm
1. Excellent	<0.33	<0.67	<1.00
2. Good	0.33 to .67	0.67 to 1.33	1.00 to 2.00
3. Permissible	0.67 to 1.00	1.33 to 2.00	2.00 to 3.00
4. Doubtful	1.00 to 1.25	2.00 to 2.50	3.00 to 3.75
5. Unsuitable	>1.25	>2.50	>3.75

Based on the author's classification, both sugar beets and corn are considered tolerant crops. From the table boron concentrations of 2.00 to 3.00 ppm irrigation waters would be acceptable for the two crops.

One of the other references cited (Sprinkler Irrigation Association, 1975), however, while listing sugar beets as a tolerant crop lists corn as a semi-tolerant crop. Assuming that the boron concentrations in Scofield's table applies to this other grouping of crops, the boron limit for corn would be 1.33 to 2.00 ppm.

In comparison to the crop tolerances cited here, the estimated average boron concentrations in the applied irrigation water do not preclude irrigation of sugar beets or corn for the agricultural irrigation alternatives. However, as wide variations in boron concentrations were found in previous wastewater sampling, and as these concentrations are only marginally acceptable, additional boron analysis should be undertaken prior to a decision to rely on agricultural irrigation. Specifically, an extensive boron monitoring program is warranted, and if high concentrations are found an attempt to locate the sources should be made.

Appendix P

Alternative Costing Methodology and Assumptions

The methodology for deriving the costs based on December 1976, for all facilities described in this report is complex and requires explanation. The approach is predicated on the development of costs for each alternative that are as equal in accuracy as possible. The entire planning process is one of comparing various alternatives against each other. Therefore, the comparison of each economic analysis, to be valid, must incorporate cost data that reflects the same degree of error and level of confidence. In addition, the estimated costs must reflect those experienced in the study area to the extent possible. The third criteria is that the over-all costs, if anything, exceed, rather than be lower than, the actual costs that would be incurred if the alternative under consideration were constructed and placed in operation. In order to accomplish these ends the costs developed were based on four sources: (1) engineering costs developed by the engineering firm under contract with the local municipalities. (2) costs curves from Cost of Wastewater Treatment for Land Application (EPA, 1975c) based on February 1973 costs. (3) EPA Sewage Plant construction cost and sewer construction cost indices using the national average index and the Denver Colorado index. (4) sewage treatment plant cost curves for individual treatment components prepared for EPA and based on September 1975 costs.

The economic analysis, using capital investment and O&M estimates based on the criteria outlined above, is in accordance with the procedures described in the EPA Technical Report #EPA 430/9-75-003, Costs of Wastewater Treatment by Land Application (EPA, 1975c). Utilizing this methodology assured that the costs developed for each alternative are of equal validity

and, therefore, comparable in terms of selecting the alternative with the lowest present worth value and/or cost in cents per 1000 gallons per year.

Relying on EPA cost curves increases the comparability between alternatives, which is the primary objective of alternatives costing, at some expense to the utility of directly incorporating detailed, locally reliable cost data as presented in the three Facilities Plans. Difficulties in integrating both cost curve and detailed cost information are, in large part, due to the manner in which equipment installation ("electrical and mechanical") and additional building costs are reported in each costing methodology. Cost curves are developed so that all costs necessary to the installation of the equipment and buildings are included in the development of the curves. Therefore, the proportion of the cost attributable to installation requirements and building are an integral part of and cannot be separated from the total cost derived for the curves. In contrast, installation and building costs reported in the Facilities Plans were lump sum figures that covered all of the components, i.e., collection, transport, treatment and disposal facilities costs included in each alternative.

These lump sum costs were broken down and allocated to each system component in proportions estimated to be applicable. The costs for each component then were comparable with those provided by the cost curves. Costs for various system components derived are valid only for the design size (hydraulic capacity, storage volume, acres, etc.) of the treatment component. Application of unit costs to similar units of different size considered in the system and regional alternatives developed have relied upon non-linear scaling factors provided by the cost curves. Thus unit costs increased for smaller design capacities and decreased for design capacities that were higher than those used for Gering in the Facilities Plan.

Some facilities considered here had to be costed directly from the available cost curves. The integration of detailed engineering costs reported in the Facilities Plan with EPA cost curve data is felt to provide the highest degree of comparability between alternatives without significant loss of accuracy.

The costs reported using cost curves all have a December, 1976 base for Denver, Colorado, the nearest city to the study area for which EPA maintains an index. The cost indices used to scale available cost curve data to this base are shown in Table P-1.

Table P-1

Sewage Plant and Sewer Construction () Cost Index

<u>Cost Curve Reference</u>	<u>Base Date</u>	<u>National</u>	<u>Cincinnati, OH</u>	<u>Denver, CO</u>
EPA, 1977 ^a	Dec. 1976	270.3 (283.1)	--	255.7 (249.5)
b	Sep. 1975	251.3	255.9	232.9
EPA, 1975 ^b	Feb. 1973	177.5 (194.2)		159.31 (160.7)

a The December 1976 data is the base year used for all costs developed in this study.

b The September 1975 data is the base year used for development of costs for various system components such as vacuum filtration, in the cited reference.

c February 1973 data is the base year for capital and O&M costs of the irrigation and complete retention alternatives.

A 7 percent interest rate was used in discounting salvage values, and in calculating average annual costs from present worth.

The cost effectiveness analysis of alternatives assumes that additional land for treatment facilities and effluent disposal sites will be purchased. Alternative means for acquiring land rights are feasible but have not been incorporated at this level of analysis. Land costs used in the cost effective analysis are listed in Table

Cost effective analysis permits the incorporation of changes in agricultural productivity. Associated with land taken out of production for storage ponds or complete retention lagoons are opportunity costs equal to the difference between expected crop worth (harvest or range rental value) and costs to produce the harvest. These values for each of the effluent disposal sites or areas are listed in Table as "Existing Net Crop Benefits" expressed as dollars per acre per year (\$/ac.-yr).

For acreage that would be irrigated, the economic benefit is calculated as the difference between "irrigated Net Crop Benefits" as listed in Table

and "Existing Net Crop Benefits." "Irrigated Net Crop Benefits" are the difference between expected crop worth (sugar beets at \$30/ton and 22 ton/acre for center pivot, 20 tons/acre for ditch irrigation) and municipal costs to produce the harvest. Not included in "municipal costs to produce the harvest" are land costs and interest on the land (included separately in the cost-effective analysis), ammonia application costs, overhead fees, and irrigation district fees, and fixed machinery costs for center pivot irrigation equipment (accounted separately). Included in municipal costs to produce the harvest are seeds, other fertilizers besides ammonia, herbicides, pesticides, labor, management fees, non-fixed machinery costs, fixed machinery costs for other than center pivot irrigation equipment and

Table P-2

Land and Net Crop Benefit Values Used in Alternatives Costing

<u>Site</u>	<u>Present Use</u>	<u>Land Cost^a (\$/acre)</u>	<u>Present Annual Net Crop Benefit^b (\$/acre)</u>	<u>Irrigated Net Crop Benefit^c (\$/acre)</u>
North	Range	120	5.20	293.
South	Wheat	350	15.80	293
Valley- Irrigation	Sugar beets- Irrigated	1900	205.70	238
Valley- Retention	Permanent Pasture	150	6.00	--

^a Estimates provided by R. Retzlaff, U. of Neb. Farm Management Extension Service.

^b From data published in "Nebraska Estimated Crop and Livestock Production Costs -- 1977" (U. Nebraska - 1976). Net crop benefit is taken as the difference between average crop value and direct production costs. Average crop values used were:

Sugar Beets - 22 ton/acre x \$30/ton.
 Wheat - 34 bu/acre x \$2.50/bu.
 Pasture & Range - annual rental value per acre.

^c Assumes land and irrigation equipment purchase by municipalities. Credit given for nitrogen in wastewater = \$22/acre-year. Credit for avoidance of irrigation fees (Valley-Irrigation site) = \$8/ac.-yr. Value of taxes = 1% of land value included as production cost since this is revenue that the municipalities will forfeit under a purchase arrangement.

taxes in the amount of one percent of land value. The latter cost is appropriate because it represents lost revenue to a local government even though it may not be the government owning the land.

For the Valley areas and South site expected crop yields and costs to produce the various crops were calculated from current data published by the Cooperative Extension Service, Institute of Agricultural and Natural Resources (University of Nebraska, 1976). Unit worths of crops (\$2.50/bushel for wheat; \$30/ton for sugar beets) are higher than recent market values but are expected long-term values of these crops in current dollars.

APPENDIX Q

ESTIMATED TOTAL PROJECT COSTS

- Scottsbluff
- Gering
- Terrytown
- Regional

ESTIMATED TOTAL PROJECT COSTS

<u>Scottsbluff</u>	Complete Retention - North Site (Alternative C.R.N.)		
	costs \$ (x 1000)		
A. Modification to Existing Facilities	Capital	Salvage	O & M
1. Comminutor, gates, flow measurement, new pumps, valves, piping	100		
2. Open channel (concrete lined trape- zoidal ditch)	30		22
B. Disposal by Complete Retention - North Site			
1. Pumping station	352		67
2. Piping, manholes, control building	78	39	4
3. Transmission	2182	1091	5
4. Site improvement	18		
5. Retention pond	1812	906	16
	4572		
Service factor (127) - engineering, administration and contingencies	5806		
6. Land (incl. loss of land income)	49	49	2
	5855	2005	
-Present worth of salvage value	-518		
C. Total Cost	5337		116

Amortized Capital Cost \$503,800 per year

Total Annual Cost \$619,800 per year

Cost c/1000 Gal. 52.73c

ESTIMATED TOTAL PROJECT COST

<u>Scottsbluff</u>	Complete Retention - South Site (Alternative C.R.S.)		
	costs \$ (x 1000)		
A. Modifications to Existing Facilities	Capital	Salvage	O & M
1. Comminutor, gates, flow measurement, new pumps, valves, piping	100		
2. Open channel (concrete lined trape- zoidal ditch)	30		22
B. Disposal by Complete Retention - South Site			
1. Pumping station	294		44
2. Piping, manholes, control building	78	39	4
3. Transmission	1337	669	6
4. Site improvement	18		
5. Retention pond	1812	906	16
	3669		
Service factor (1.27) - engineering, administration, and contingencies	4660		
6. Land (incl. loss of land income)	143	143	7
	4803	1757	
-Present worth of salvage value	-454		
C. Total Cost	4349		99

Amortized Capital Cost \$410,500 per year
 Total Annual Cost \$509,500 per year
 Cost c/1000 Gal. 43.35¢

ESTIMATED TOTAL PROJECT COST

<u>Scottsbluff</u>	Complete Retention - Valley Site (Alternative C.R.V.)		
	costs \$ (x 1000)		
A. Modifications to Existing Facilities	Capital	Salvage	O & M
1. Comminutor, gates, flow measurement, new pumps, valves, piping	100		
2. Open channel (concrete lined trape- zoidal ditch)	30		22
B. Disposal by Complete Retention - Valley Site			
1. Pumping Station	253		20
2. Piping, manholes, control building	50	25	3
3. Transmission	216	108	1
4. Site improvement			
5. Retention pond	1812	906	16
	2461		
Service factor (1.27) - engineering, administration, and contingencies	3125		
6. Land (incl. loss of land income)	61	61	2
	3186	1100	
-Present worth of salvage value	-284		
C. Total Cost	2901		64

Amortized Capital Cost	\$273,800 per year
Total Annual Cost	\$337,800 per year
Cost c/1000 Gal.	28.74¢

ESTIMATED TOTAL PROJECT COST

<u>Scottsbluff</u>		Agricultural Irrigation-North Site (Alternative A.I.N.)		
		costs \$ (x 1000)		
A. Modifications to Existing Facilities		Capital	Salvage	O & M
1. Comminutor, gates, flow measurement new pumps, valves, piping	100 76		38	
2. Operations building				
3. Open channel (concrete lined trape- zoidal ditch)	21			22
Aerated Lagoon				
1. Basin (using bentonite)	113		57	38
2. Diffused air system	272			70
Chlorination (O & M cost only)				22
B. Disposal by Agricultural Irrigation - North Site				
1. Pumping station	352			67
2. Transmission	2,182		1,091	5
3. Storage pond	1,016		508	6
4. Site improvement	56			
5. Distribution	772			123
6. Administration building and laboratory	120		60	14
7. Road, fencing, monitoring wells	10			13
	5,090			
Service factor (1.27) - engineering, administration, and contingencies	6,464			
8. Land (incl. loss of land income from storage pond)	167		167	1
	6,631		1,921	
-Present worth of salvage value	- 496			
	7,127			381
C. Total Cost				
	Project cost	7,127		381
	-crop benefits			300
	NET COST	7,127		81
Amortized Capital Cost \$672,700 per year				
Total Annual Cost \$673,500 per year				
Cost c/1000 Gal. 57.30c				

ESTIMATED TOTAL PROJECT COST

<u>Scottsbluff</u>		Agricultural Irrigation-South Site (Alternative A.I.S.)		
		costs \$ (x 1000)		
A. Modifications to Existing Facilities		Capital	Salvage	O & M
1. Comminutor, gates, flow measurement, new pumps, valves, piping	100			
2. Operations building	76		38	
3. Open channel (concrete lined trape- zoidal ditch)	21			22
Service factor (1.27) - engineering, administration, and contingencies	292			
Aerated Lagoon				
1. Basin (using bentonite)	113		57	38
2. Diffused air system	272			70
Chlorination (O & M cost only)				22
B. Disposal by Agricultural Irrigation= South Site				
1. Pumping station	294			44
2. Transmission	1,337		669	3
3. Storage pond	1,016		508	6
4. Site improvement	56			
5. Distribution	772			123
6. Administration building and laboratory	120		60	14
7. Road, fencing, monitoring wells	10			13
	4,187			
Service factor (1.27) - engineering, administration, and contingencies	5,317			
8. Land (incl. loss of land income from storage pond)	487	487		2
	5,804	1,819		
-Present worth of salvage value	470			
	5,334			358
C. Total Cost				
Project Cost	5,334			358
-crop benefits				289
NET COST	5,334			69
Amortized Capital Cost	\$ 503,500 per year			
Total Annual Cost	\$ 572,500 per year			
Cost ¢/1000 Gal.	48.71¢			

ESTIMATED TOTAL PROJECT COST

<u>Scottsbluff</u>		Agricultural Irrigation-Valley Site (Alternative A.I.V.)		
		costs \$ (x 1000)		
		Capital	Salvage	O & M
A. Modifications to Existing Facilities				
1. Comminutor, gates, flow measurement, new pumps, valves, piping	100			
2. Operations building	76	38		
3. Open channel (concrete lined trape- zoidal ditch)	21			22
Aerated Lagoon				
1. Basin (using bentonite)	113	57		38
2. Diffused air system	272			70
Chlorination (O & M cost only)				22
B. Disposal by Agricultural Irrigation- Valley Site				
1. Pumping Station	253			20
2. Transmission	216	108		1
3. Storage pond	1,016	508		6
4. Site improvement				63
5. Distribution				14
6. Administration building and laboratory	80	40		13
7. Road, fencing, monitoring wells	10			
	2,157			
Service factor (1.27) - engineering, administration, and contingencies	2,739			
8. Land (incl. loss of land income from storage pond)	2,642	2,642		29
	5,381	3,393		
-Present worth of salvage value	- 877			
	4,504			298
C. Total Cost				
	Total Cost	4,504		298
	-crop benefits			33
	NET COST	4,504		265
Amortized Capital Cost \$ 425,000 per year				
Total Annual Cost \$ 690,000 per year				
Cost ¢/1000 Gal. 58.71 ¢				

ESTIMATED TOTAL PROJECT COST

<u>Scottsbluff</u>		Activated Bio-filter with Nitrification (Alternative SD1)			costs \$ (x 1000)	
A. Activated Bio-filter (with Sludge Digestion)					<u>Capital Salvage O & M</u>	
1.	Modifications to Existing Facilities			\$	112	
2.	Two Primary Clarifiers				203	
3.	ABF Lift Station				48	
4.	ABF Tower				258	
5.	Aeration Basin, Including Aerators				139	
6.	Two Final Clarifiers				283	
7.	Sludge and Scum Pumps				41	
8.	Yard Piping, Values and Manholes				336	
9.	Digested Sludge Clarifer				25	
10.	Aerobic Digester, including Aerators				252	
11.	Vacuum Filter				242	
12.	Blowers				123	
13.	Site Work				85	
14.	Operations Building				42	
15.	Lab Equipment				45	
16.	Mechanical				39	
17.	Electrical				158	
18.	New Airport Outfall, Lift Station and Force Main				112	
19.	Dewatering				17	
20.	Final Effluent Outfall				37	
					\$2,639	210 245*
Service factor (1.27) - engineering, administration and contingencies					3,352	
-Present worth of salvage value (Including salvage value of 80 acres of abandoned lagoons)					-166	
Amortized capital cost		301,000			3,186	245
Total annual cost		54,600				
Cost ¢/1000 ga.		46.46				
B.	NITRIFICATION	¢/1000 gal				
	Capital Cost	6.75				
	O & M cost	5.33				
		12.08				
C.	TOTAL COST					
	Activated bio-filter	46.46 ¢/1000 gal				
	Nitrification	12.08 ¢/1000 gal				
	Total Cost	58.54 ¢/1000 gal				

*O & M costs increased by EPA cost curves

ESTIMATED TOTAL PROJECT COST

Scottsbluff

Stream Discharge Upgrade Lagoons-No Industrial Pretreatment (Alternative S.D. 2)

A. Modifications to Existing Facilities	costs \$ (x 1000)		
	Capital	Salvage	O & M
1. Comminutor, gates, flow measurement	100		
2. Airport lift station and dewatering	115		
3. Operations building	76	38	
4. Outfall	33		
5. Open channel (concrete lined trapezoidal ditch)	21		22
Preliminary Treatment by DAF	402	50	120
Aerated Lagoon			
1. Basin (using beutonite)	113	57	38
2. Diffused air system	272		70
Treatment of Final Effluent by DAF	188	24	70
Sludge Dewatering System			
1. Storage tank	26		
2. Vacuum filter	215	27	40
3. Pump station	76		7
4. Truck haul to landfill			10
5. Force main (14")-discharge to inlet end	66	33	1
Stabilization Pond Cleanout (one lagoon per year)			23
	1,703	229	
Service factor (1.27) - engineering, administration, and contingencies	2,163		
-Present worth of salvage value	- 59		
	2,104		401

B. Total Cost

Amortized Capital Cost	\$199,000 per year
Total Annual Cost	600,000 per year
Cost ¢/1000 Gal.	51.05 ¢

ESTIMATED TOTAL PROJECT COST

<u>Scottsbluff</u>	Stream Discharge Upgrade Lagoons-Industrial Pretreatment by Screening and DAF (Alternative S.D.3)		
	costs \$ (x 1000)		
A. Modifications to Existing Facilities	Capital	Salvage	O & M
1. Comminutor, gates, flow measurement	100		
2. Airport lift station and dewatering	115		
3. Operations building	76	38	
4. Outfall	33		
5. Open channel (concrete lined trapezoidal ditch)	21		22
Aerated Lagoon			
1. Basin (using bentonite)	113	57	38
2. Diffused air system	272		70
Treatment of Final Effluent by DAF	188	24	88
Sludge Dewatering System			
1. Storage tank	10		
2. Vacuum filter	116	15	18
3. Truck haul to landfill			3
Industrial Pretreatment			
1. DAF	55		2
	1,099	134	241
Service factor (1.27) - engineering, administration, and contingencies	1,396		
-Present worth of salvage value	- 35		
	1,360		241
B. Total Cost			
Amortized Capital Cost	\$128,400 per year		
Total Annual Cost	369,400 per year		
Cost ¢/1000 Gal.	31.43¢		

ESTIMATED TOTAL PROJECT COST

Scottsbluff

Stream Discharge
Upgrade Lagoons -
Maximum Industrial Pretreatment
(Alternative S.D.4)

A. Modifications to Existing Facilities	costs \$ (x 1000)		
	Capital	Salvage	O & M
1. Comminutor, gates, flow measurement	100		
2. Airport lift station and dewatering	115		
3. Operations building	76	38	
4. Outfall	33		
5. Open channel (concrete lined trapezoidal ditch)	21		22
Treatment of Final Effluent by DAF	188	24	88
Sludge Dewatering System			
1. Storage tank	10		
2. Vacuum filter	116	15	18
3. Truck haul to landfill			3
Industrial Pretreatment			
1. DAF and anaerobic/aerobic lagoons	340		30
	999	77	
Service factor (1.27) - engineering, administration, and contingencies	1269		
-Present worth of salvage value	- 20		
	1249		161

B. Total Cost

Amortized Capital Cost \$ 118,000 per year
Total Annual Cost 279,000 per year
Cost ¢/1000 Gal. 23.74¢

ESTIMATED TOTAL PROJECT COST

<u>Gering</u>	Complete Retention-North Site (Alternative C.R.N.)		
	costs \$ (x 1000)		
A. Modifications to Existing Facilities	Capital	Salvage	O & M
1. Inlet structure	31		
2. Flow measurement	12		
3. Bank protection (riprap)	78		10
Diffused Air System & Operations Building	295	37	32
B. Disposal by Complete Retention-North Site			
1. Pumping station	214		49
2. Piping, manholes, control building	78	39	4
3. Transmission	2,380	1,190	6
4. Site improvement	16		
5. Retention pond	1,577	786	14
	4,681		
Service factor (1.27) - engineering, administration, and contingencies	5,945		
6. Land (incl. loss of land income)	43	43	2
	5,988	2,095	
-Present worth of salvage value	541		
C. Total Cost	5,446		117

Amortized Capital Cost	\$514,000 per year
Total Annual Cost	\$631,000 per year
Cost ¢/1000 Gal.	72.64¢

ESTIMATED TOTAL PROJECT COST

<u>Gering</u>	Complete Retention - South Site (Alternative C.R.S.)		
	costs \$ (x 1000)		
A. Modifications to Existing Facilities	Capital	Salvage	O & M
1. Inlet structure	31		
2. Flow measurement	12		
3. Bank protection (riprap)	78		10
Diffused Air System & Operations Building	295	37	32
B. Disposal by Complete Retention-South Site			
1. Pumping station	164		34
2. Piping, manholes, control building	78	39	4
3. Transmission	1,305	653	4
4. Site improvement	16		
5. Retention pond	1,577	786	14
	3,556		
Service factor (1.27) - engineering, administration, and contingencies	4,516		
6. Land (incl. loss of land income)	124	124	6
	4,640	1,639	
-Present worth of salvage value	-424		
C. Total Cost	4,216		104
Amortized Capital Cost	\$398,000 per year		
Total Annual Cost	\$502,000 per year		
Cost ¢/1000 Gal.	57.79¢		

ESTIMATED TOTAL PROJECT COST

<u>Gering</u>	Complete Retention - Valley Site (Alternative C.R.V.)		
	costs \$ (x 1000)		
	Capital	Salvage	O & M
A. Modifications to Existing Facilities			
1. Inlet structure	31		
2. Flow measurement	12		
3. Bank protection (riprap)	78		10
Diffused Air System & Operations Building	295	37	32
B. Disposal By Complete Retention - Valley Site			
1. Pumping station	134		15
2. Piping, manholes, control building	50	25	3
3. Transmission	108	54	1
4. Retention pond	1,577	786	14
	2,285		
Service Factor (1.27) - engineering, administration, and contingencies	2,902		
5. Land (incl. loss of land income)	53	53	2
	2,955	955	
-Present worth of salvage value	-247		
C. Total Cost	2,708		77
Amortized Capital Cost \$255,600 per year			
Total Annual Cost \$332,600 per year			
Cost ¢/1000 Gal. 38.28¢			

ESTIMATED TOTAL PROJECT COST

<u>Gering</u>		Agricultural Irrigation-North Site (Alternative A.I.N.1)		
		costs \$ (x 1000)		
A. Modifications to Existing Facilities		Capital	Salvage	O & M
1. Inlet structure		30		
2. Lift station		64		
3. Flow measurement		12		
4. Piping, controls, manholes		121	60	16
5. Bank protection (riprap)		78		
6. Electrical and mechanical		10		
Diffused Air System & Operations Building		295	37	32
New 100 Ac. Stabilization Ponds for Domestic Waste				
1. 100 ac. stabilization ponds		532	266	15
2. Transmission (domestic)		66	33	2
3. Land (incl. loss of land income)		(168)	168	23
Chlorination (O & M cost only)				16
B. Disposal by Agricultural Irrigation-North Site		214		4
1. Pumping station		214		49
2. Transmission		2,464	1,232	6
3. Storage pond		861	431	5
4. Site improvement		48		
5. Distribution		590		94
6. Administration building and laboratory		90	45	10
7. Road, fencing, monitoring wells		10		10
		5,485		
Service factor (1.27) - engineering, administration, and contingencies		6,966		
8. Land (incl. loss of land income from storage pond)		128	128	1
		7,094	2,400	
-Present worth of salvage value		620		
		6,473		279
C. Total Cost				
	Project Cost	6,473		279
	-Crop Benefits			226
	NET COST	6,473		53
Amortized Capital Cost		\$611,000 per year		
Total Annual Cost		\$664,000 per year		
Cost ¢/1000 Gal.		76.44¢		

ESTIMATED TOTAL PROJECT COST

<u>Gering</u>	Agricultural Irrigation-South Site (Alternative A.I.S.1)		
	costs \$ (x 1000)		
A. Modifications to Existing Facilities	Capital	Salvage	O & M
1. Inlet structure	30		
2. Lift station	64		
3. Flow measurement	12		
4. Piping, controls, manholes	121	60	16
5. Bank protection (rip rap)	78		
6. Electrical and mechanical	10		
Diffused Air System & Operations Building	295	37	32
New 100 Ac. Stabilization Ponds for Domestic Waste			
1. 100 Ac. stabilization ponds	532	266	15
2. Transmission (domestic)	66	33	2
3. Land (including loss of land income)	(168)	168	23
Chlorination (O & M cost only)			16
B. Disposal by Agricultural Irrigation-South Site			
1. Pumping station	164		34
2. Transmission	1,221	611	4
3. Storage pond	861	431	5
4. Site improvement	48		
5. Distribution	590		94
6. Administration building and laboratory	90	45	10
7. Road, fencing, monitoring wells	10		10
	4,192	2,078	
Service factor (1.27) - engineering, administration, and contingencies	5,324		
8. Land (incl. loss of land income for storage pond)	373	373	2
	5,697	2,024	
-Present worth of salvage value	-523		
	5,174		263
C. Total Cost			
Project Cost	5,174		263
-Crop Benefits			218
NET COST	5,174		45
Amortized Capital Cost	\$488,400 per year		
Total Annual Cost	\$533,400 per year		
Cost ¢/1000 Gal.	61.40¢		

ESTIMATED TOTAL PROJECT COST

<u>Gering</u>	Agricultural Irrigation-Valley Site (Alternative A.I.V.1)		
	costs \$ (x 1000)		
A. Modifications to Existing Facilities	Capital	Salvage	O & M
1. Inlet structure	30		
2. Lift station	64		
3. Flow measurement	12		
4. Piping, controls, manholes	121	60	16
5. Bank protection (rip rap)	78		
6. Electrical and mechanical	10		
Diffused Air System & Operations Building	295	37	32
New 100 Ac. Stabilization Ponds for Domestic Waste			
1. 100 Ac. stabilization ponds	532	266	15
2. Transmission (domestic)	66	33	2
3. Land (incl. loss of land income)	(168)	168	23
Chlorination (O & M cost only)			16
B. Disposal by Agricultural Irrigation-Valley Site			
1. Pumping station	134		15
2. Transmission	108	54	1
3. Storage pond	861	431	5
4. Site improvement			
5. Distribution			47
6. Administration building and laboratory	65	33	10
7. Road, fencing, monitoring wells	10		10
	2,386		
Service Factor (1.27) - engineering, administration, and contingencies	3,030		
8. Land (incl. loss of land income from storage pond)	2,027	2,027	25
	5,057	3,109	
-Present worth of salvage value	803		
	4,254		217
C. Total Cost			
Project Cost	4,254		217
-Crop Benefits			25
NET COST	4,254		192
Amortized Capital Cost	\$401,500 per year		
Total Annual Cost	\$593,500 per year		
Cost ¢/1000 Gal.	68.32¢		

ESTIMATED TOTAL PROJECT COST

<u>Gering</u>	Stream Discharge Upgrade Lagoons-New Domestic Site (Alternative S.D. 1) costs \$ (x 1000)		
	Capital	Salvage	O & M
A. Modifications to Existing Facilities			
1. Inlet structure	30		
2. Lift station	64		
3. Flow measurement	12		
4. Piping, controls, manholes	121	60	16
5. Bank protection (rip rap)	78		
6. Electrical and mechanical	10		
Diffused Air System & Operations Building	295	37	32
New 100 Ac. Stabilization Ponds for Domestic Waste			
1. 100 Ac. stabilization ponds	532	266	15
2. Transmission (domestic)	66	33	2
3. Land	(168)	168	23
Treatment of Final Combined Effluent by DAF	168	21	65
Transport of Industrial Waste			
1. Pump station (industrial final effluent)	57		2
2. Transport pipe for industrial discharge	66	33	1
Sludge Dewatering System			
1. Storage tank	13		
2. Vacuum filter	198	25	16
3. Truck haul to landfill			3
	1,710	643	
Service factor (1.27) - engineering, administration, and contingencies	2,172		
(land)	2,340		
-Present worth of salvage value	- 166		
B. Total Cost	2,174		175

Amortized Capital Cost
Total Annual Cost
Cost ¢/1000 Gal.

\$205,000 per year
380,000 per year
43.74¢

ESTIMATED TOTAL PROJECT COST

<u>Gering</u>	Stream Discharge Upgrade Lagoons-No New Domestic Site (Alternative S.D.2) costs \$ (x 1000)		
	Capital	Salvage	O & M
A. Modifications to Existing Facilities			
1. Inlet structure	30		
2. Lift station	64		
3. Flow measurement	12		
4. Piping controls, manholes	121	60	16
5. Bank protection (rip rap)	78		
6. Electrical and mechanical	10		
Diffused Air System & Operations Building	295	37	32
New Aerated Lagoon For Domestic Waste			
1. Basin (using bentonite)	73	37	27
2. Diffused air system	181		48
Treatment of Final Combined Effluent by DAF	168	21	65
Sludge Dewatering System			
1. Storage tank	13		
2. Vacuum filter	198	25	16
3. Truck haul to landfill			3
	1,243	180	
Service Factor (1.27) - engineering, administration, and contingencies	1,579		
-Present worth salvage value	-47		
	1,532		207
B. Total Cost			
Amortized Captical Cost	\$145,000 per year		
Total Annual Cost	352,000 per year		
Cost ¢/1000 Gal.	40.52¢		

ESTIMATED TOTAL PROJECT COST

Gering

Agricultural Irrigation-North Site (Alternative A.I.N.2)

		costs \$ (x 1000)		
		Capital	Salvage	O & M
A. Modifications to Existing Facilities				
1. Inlet structure		30		
2. Lift station		64		
3. Flow measurement		12		
4. Piping, controls, manholes		121	60	16
5. Bank protection (rip rap)		78		
6. Electrical and mechanical		10		
Diffused Air System & Operations Building		295	37	32
New Aerated Lagoon For Domestic Waste				
1. Basin (using bentonite)		73	37	27
2. Diffused air system		181		48
Chlorination (O & M cost only)				16
B. Disposal By Agricultural Irrigation-North Site				
1. Pumping station		214		49
2. Transmission		2,380	1,190	6
3. Storage pond		861	431	5
4. Site improvement		48		
5. Distribution		590		94
6. Administration building and laboratory		90	45	10
7. Road, fencing, monitoring wells		10		10
		5,057		
Service factor (1.27) - engineering, administration, and contingencies		6,422		
8. Land (incl. loss of land from storage pond)		128	128	1
		6,550	1,928	
-Present worth of salvage value		-498		
		6,052		314
C. Total Cost	Project Cost	6,052		314
	-Crop Benefits			226
	NET COST	6,052		88

Amortized Capital Cost	\$571,000 per year
Total Annual Cost	\$659,000 per year
Cost ¢/1000 Gal.	75.86¢

ESTIMATED TOTAL PROJECT COST

Gering

Agricultural Irrigation-South Site (Alternative A.I.S.2)

		costs \$ (x 1000)		
		Capital	Salvage	O & M
A. Modifications to Existing Facilities				
1. Inlet structure		30		
2. Lift station		64		
3. Flow measurement		12		
4. Piping, controls, manholes		121	60	16
5. Bank protection (rip rap)		78		
6. Electrical and mechanical		10		
Diffused Air System & Operations Building		295	37	32
New Aerated Lagoon for Domestic Waste				
1. Basin (using bentonite)		73	37	27
2. Diffused air system		181		48
Chlorination (O & M cost only)				16
B. Disposal by Agricultural Irrigation-South Site				
1. Pumping station		164		34
2. Transmission		1,305	653	4
3. Storage pond		861	431	5
4. Site improvement		48		
5. Distribution		590		90
6. Administration building and laboratory		90	45	10
7. Road, fencing, monitoring wells		10		10
		3,932		
Service factor (1.27) - engineering, administration, and contingencies		4,994		
8. Land (incl. loss of land income from storage pond)		374	374	2
		5,368	1,637	
-Present worth of salvage value		-423		
		4,945		298
C. Total Cost				
	Project Cost	4,945		298
	-Crop Benefits			218
	NET COST	4,945		80
Amortized Capital Cost \$466,700 per year				
Total Annual Cost \$546,700 per year				
Cost ¢/1000 Gal. 62.93¢				

ESTIMATED TOTAL PROJECT COST

Gering

Agricultural Irrigation-Valley Site (Alternative A.I.V.2)

		costs \$ (x 1000)		
		Capital	Salvage	O & M
A. Modifications to Existing Facilities				
1. Inlet structure		30		
2. Lift station		64		
3. Flow measurement		12		
4. Piping, controls, manholes		121	60	16
5. Bank protection (rip rap)		78		
6. Electrical and mechanical		10		
Diffused Air System & Operations Building		295	37	32
New Aerated Lagoon for Domestic Waste				
1. Basin (using bentonite)		73	37	27
2. Diffused air system		181		48
Chlorination (O & M cost only)				16
B. Disposal by Agricultural Irrigation-Valley Site				
1. Pumping station		134		15
2. Transmission		108	54	1
3. Storage pond		861	431	5
4. Site improvement				
5. Distribution				47
6. Administration building and laboratory		65	33	10
7. Road, fencing, monitoring wells		10		10
		2,042		
Service Factor (1.27) - engineering, administration, and contingencies		2,593		
8. Land (incl. loss of land income from storage pond)		2,027	2,027	25
		4,620	2,679	
-Present worth of salvage value		-692		
		3,928		252
C. Total Cost				
	Project Cost	3,928		252
	-Crop benefits			25
	NET COST	3,928		227
Amortized Capital Cost \$370,000 per year				
Total Annual Cost \$597,800 per year				
Cost ¢/1000 Gal. 68.81 ¢				

ESTIMATED TOTAL PROJECT COST

Terrytown

Abandon Existing Plant
Pump Raw Sewage to Gering
(Alternative T.1.G)

	costs \$ (x 1000)		
	Capital	Salvage	O&M
A. Abandon Plant and Pump			
New Lift Station	33	0	3
8-Inch Force Main to Gering Lagoon System	128	64	
Salvage Value - Existing Plant		8	
B. Service Charge by Gering (at \$.09/1000 gal.)			8
	161	72	11
Service Factor (1.27)- Engineering, Administration, and Contingencies	204		
-Present Worth of Salvage Value	-19		
	185		11
C. Total Cost			

Amortized Capital Cost	\$ 17,500 per year
Total Annual Cost	28,500 per year
Cost ¢/1000 gal.	31.2¢

ESTIMATED TOTAL PROJECT COST

Terrytown

Abandon Existing Plant
Pump Raw Sewage to Scottsbluff
(Alternative T.1.S)

	costs \$ (x1000)		
	Capital	Salvage	O&M
A. Abandon Plant and Pump			
New Lift Station	33	0	2
New 8-Inch Force Main to Scottsbluff Interceptor	16	8	
Salvage Value - Existing Plant		8	
B. Service Charge by Scottsbluff (at \$.09/1000 gal.)			8
C. Provide Hydraulic Capacity in Scottsbluff Interceptor			
New Sanitary Sewer to Replace Broadway Avenue Combined Sewer	100	59	
Reroute Scottsbluff Concrete Sewer and Sewer Sanitary Connections	50	25	
	199	91	10
Service Factor (1.27)- Engineering, Administration, and Contingencies	253		
-P.W. of Salvage Value	-23		
	230		10
D. Total Cost			

Amortized Capital Cost	\$21,700 per year
Total Annual Cost	31,700 per year
Cost ¢/1000 gal.	34.8¢

ESTIMATED TOTAL PROJECT COST

Terrytown

Stream Discharge
Truck Waste Activated Sludge to Scottsbluff
(Alternative T.2)

A. Modifications to Existing Facilities	costs \$ (x 1000)		
	Capital	Salvage	O & M
1. Chemical Feed System	7		
2. Flow Measurement and Sampling Equipment	8		
3. Minor Changes to Flow Pattern through Existing Facility	10		
4. Truck haul to Scottsbluff			1
5. Sludge Digestion and Disposal at Scottsbluff			3
	25		
Service factor (1.27) - engineering, administration, and contingencies	32		23*

B. Total Cost

Amortized Capital Cost \$ 3,000 per year
Total Annual Cost \$26,000 per year
Cost ¢/1000 Gal. 28.5¢

* Itemized O & M cost plus:

\$5,000/year for electrical power
\$2,000/year for mechanical repairs and equipment replacement
\$9,000/year for labor
\$3,000/year for chemicals

ESTIMATED TOTAL PROJECT COST

<u>Terrytown</u>	Stream Discharge Modifications to Existing Facilities (Alternative T.3)		
	costs \$ (x 1000)		
A. Modifications to Existing Facilities	Capital	Salvage	O & M
1. New Aerobic Digester and Equipment	\$ 38		
2. Addition to Existing Building	11	5	
3. Chemical Feed System	7		
4. Flow Measurement and Sampling Equipment	8		
5. Site Improvements	2		
6. Electrical	13		
7. Mechanical	3		
8. Minor Changes to Flow Pattern through Existing Facility	10		
9. Drying Beds	2		1
	94	5	25*
Service Factor (1.27) - engineering administration and contingencies	119		
-Present worth of salvage value	-1		
	118		25

B. Total Cost

Amortized Capital Cost	\$11,100 per year
Total Annual Cost	\$36,100 per year
Cost ¢/1000 Gal.	39.64¢

*Total O & M for "Option IV - Modifications to Existing Facilities for Discharge Directly to North Platte River" in the draft Terrytown Facilities Plan, plus \$1,000 per year for sludge drying bed O & M.

ESTIMATED TOTAL PROJECT COST

Complete Regional Alternative - All Three Towns		Activated Sludge with Nitrification (Alternative R.S.D.1)		
		costs \$ (x 1000)		
A. Activated Sludge (with Sludge Digestion)		Capital	Salvage	O & M
1. Modifications to Existing Facilities	112			
2. Two Primary Clarifiers	291			17
3. Two Aeration Basins, Including Aerators	540			77
4. Two Final Clarifiers	480			26
5. Sludge and Scum Pumps	82			5
6. Yard Piping, Valves and Manholes	420		210	
7. Anaerobic Digester	974			41
8. Vacuum Filter	504			96
9. Gravity Sludge Thickener	123			3
10. Site Works	127			
11. Operations Building	106		53	69
12. Lab Equipment	56			
13. Mechanical	77			46
14. Electrical	256			
15. New Airport Outfall, Lift Station and Force Main	112			
16. Dewatering	17			
17. Final Effluent Outfall	67			
18. Nitrification	694			75
19. Transmission (Gering & Terrytown)	151		59	6
		5,189	322	
Service factor (1.27) - engineering, administration, and contingencies		6,590		
- Present Worth of Salvage Value (Including salvage value of Gering and Terrytown plants)		-298 -298		
		6,301		462
B. Total Cost				

Amortized Capital Cost	\$ 595,000 per year
Total Annual Cost	\$ 1,057,000 per year
Cost ¢/1000 Gal.	49.50¢

ESTIMATED TOTAL PROJECT COST

Joint Effluent Clarification and Algae Sludge Processing - All Three Towns

Joint Effluent Clarification (Alternative R.S.D.2)

	costs \$ (x 1000)		
	Capital	Salvage	O & M
A. Treatment - Scottsbluff (with Terrytown)			
Modifications to Existing Facilities	345	38	24
Aerated Lagoon	416	61	116
Stabilization Pond Cleanout (one lagoon per year)			23
Terrytown Pumping Station	33		5
Terrytown Force Main to Scottsbluff Interceptor	10	5	
B. Treatment - Gering			
Modifications to Existing Facilities	315	60	16
Diffused Air System and Operations Building	295	37	32
New Aerated Lagoon for Domestic Waste	254	37	75
C. Joint Effluent Clarification and Algae Sludge Processing			
Treatment of Final Combined Effluent by DAF Sludge Dewatering System	286	36	128
1. Storage Tank	32		
2. Vacuum Filter	265	33	55
3. Truck haul to landfill			6
4. 1000 ft. gravity line	8	4	
Gering Pumping Station	134		15
Gering Force Main to DAF Site	216	108	2
	2,609	419	
Service Factor (1.27) - engineering, administration, and contingencies	3,313		
-Present worth of salvage value (Includes salvage value of Terrytown plant)	-116		
	3,197		497
D. Total Cost			

Amortized Capital Cost	\$302,000
Total Annual Cost	799,000
Cost c/1000 Gal.	37.42c

ESTIMATED TOTAL PROJECT COST

Joint Effluent Disposal by Complete Retention- All Three Towns Complete Retention - North Site (Alternative RCRN)

	costs \$ (x 1000)		
	Capital	Salvage	O & M
A. Existing Lagoon Site - Scottsbluff (with Terrytown)			
Modifications to Existing Facilities	130		24
Terrytown Pumping Station	33		5
Terrytown Force Main to Scottsbluff Interceptor	10	5	
B. Existing Lagoon Site - Gering			
Modifications to Existing Facilities	121		10
Diffused Air System & Operations Building	295	37	32
C. Joint Effluent Disposal by Complete Retention- North Site			
1. Pumping Station	583		121
2. Piping, manholes, control building	78	39	8
3. Transmission	3492	1745	9
4. Site improvement	33		
5. Retention pond	3586	1793	32
	8361		
Service factor (1.27) - engineering, administration, and contingencies	10618		
Land (Including loss of land income)	97	97	4
	10715	3716	
-Present worth of salvage value (Including salvage value of Terrytown plant)	960		
	9755		245
D. Total Cost			

Amortized Capital Cost \$ 920,800 per year
Total Annual Cost \$1,165 800 per year
Cost ¢/1000 Gal. 54.60¢

ESTIMATED TOTAL PROJECT COST

Joint Effluent Disposal By Complete Retention- All Three Towns		Complete Retention - South Site (Alternative RCRN)		
		costs \$ (x 1000)		
		Capital	Salvage	O & M
A. Existing Lagoon Site - Scottsbluff (with Terrytown)				
Modifications to Existing Facilities		130		24
Terrytown Pumping Station		33		5
Terrytown Force Main to Scottsbluff Interceptor		10	5	
B. Existing Lagoon Site - Gering				
Modifications to Existing Facilities		121		10
Diffused Air System & Operations Building		295	37	32
C. Joint Effluent Disposal by Complete Retention- South Site				
1. Pumping station		470		80
2. Piping, manholes, control building		78	39	8
3. Transmission		2263	1131	5
4. Site improvement		33		
5. Retention pond		3586	1793	32
		7019		
Service factor (1.27) - engineering, administration, and contingencies		8914		
Land (Including loss of land income)		283	283	13
		9197	3288	
- Present worth of salvage value (Including salvage value of Terrytown plant)		850		
		8347		209
D. Total Cost				
Amortized Capital Cost		\$ 787,900 per year		
Total Annual Cost		\$ 996,900 per year		
Cost ¢/1000 Gal.		46.69¢		

ESTIMATED TOTAL PROJECT COST

Joint Effluent Disposal by Complete Retention-
All Three Towns

Complete Retention-Valley Site
(Alternative RCRV)

		costs \$ (x 1000)		
		Capital	Salvage	O & M
A.	Existing Lagoon Site - Scottsbluff (with Terrytown)			
	Modifications to Existing Facilities	130		24
	Terrytown Pumping Station	33		5
	Terrytown Force Main to Scottsbluff Interceptor	10	5	
B.	Existing Lagoon Site - Gering			
	Modifications to Existing Facilities	121		10
	Diffused Air System & Operations Building	295	37	32
C.	Joint Effluent Disposal by Complete Retention- Valley Site			
	1. Pumping station	396		37
	2. Piping, manholes, control building	50	25	6
	3. Transmission	360	180	3
	4. Site improvement	33		
	5. Retention pond	3,586	1,793	32
		5,014		
	Service factor (1.27) - engineering, administration, and contingencies	6,368		
	Land (including loss of land income	121	121	5
		6,489	2,161	
	-Present worth of salvage value	-558		
	(Including salvage value of Terrytown plant)	-558		
		5,931		154
D.	Total Cost			
	Amortized Capital Cost	\$ 559,800 per year		
	Total Annual Cost	\$ 713,845 per year		
	Cost ¢/1000 Gal.	33.43 ¢		

ESTIMATED TOTAL PROJECT COST

Joint Effluent Disposal by Agricultural Irrigation - All Three Towns

Agricultural Irrigation-North Site (Alternative R.A.I.N)

		costs \$ (x 1000)		
		Capital	Salvage	O & M
A. Treatment - Gering (with Terrytown)				
Modifications to Existing Facilities		315	60	16
Diffused Air System & Operations Building		295	37	32
New Aerated Lagoon for Domestic Waste		254	37	75
Terrytown Pumping Station		33		5
Terrytown Force Main		40	20	
Chlorination				16
B. Treatment - Scottsbluff				
Modifications to Existing Facilities		197	38	22
Aerated Lagoon		385	57	108
Chlorination				22
C. Joint Effluent Disposal by Agricultural Irrigation - Irrigation - North Site				
1. Pumping station		583		121
2. Transmission		3,492	1,746	9
3. Storage pond		1,424	712	9
4. Site improvement		89		
5. Distribution		1,399		227
6. Administration building and laboratory		160	80	25
7. Road, fencing, monitoring wells		16		23
		8,682		
Service factor (1.27) - engineering, administration, and contingencies		11,026		
Land		306	714	
		11,332	3,093	
-Present worth of salvage value (Including salvage value of Terrytown plant)		-807		
		10,525		710
D. Total Cost				
Project Cost		10,525		710
-Crop Benefits				552
Net Cost		10,525		158

Amortized Capital Cost \$.993,500 per year
 Total Annual Cost \$1,151,500 per year
 Cost ¢/1000 Gal. 53.93¢

ESTIMATED TOTAL PROJECT COST

Joint Effluent Disposal by Agricultural
Irrigation - All Three Towns

Agricultural Irrigation-South Site
(Alternative R.A.I.S.)

		costs \$ (x 1000)		
		Capital	Salvage	O & M
A. Treatment - Gering (with Terrytown)				
Modifications to Existing Facilities		315	60	16
Diffused Air System & Operations Building		295	37	32
New Aerated Lagoon for Domestic Waste		254	37	75
Terrytown Pumping Station		33		5
Terrytown Force Main		40	20	
Chlorination				16
B. Treatment - Scottsbluff				
Modifications to Existing Facilities		197	38	22
Aerated Lagoon		385	57	108
Chlorination				22
C. Joint Effluent Disposal by Agricultural Irrigation - South Site				
1. Pumping Station		470		80
2. Transmission		2,262	1,131	5
3. Storage pond		1,424	712	9
4. Site improvement		89		
5. Distribution		1,399		227
6. Administration building and laboratory		160	80	25
7. Road, fencing, monitoring wells		16		23
		7,339		
Service factor (1.27) - engineering, administration, and contingencies		9,321		
Land		892	892	
		10,213	3,064	
- Present worth of salvage value (Including salvage value of Terrytown plant)		-860		
		9,413		665
D. Total Cost				
Project Cost		9,413		665
-Crop Benefits				529
Net Cost		9,413		136

Amortized Capital Cost \$ 888,500
Total Annual Cost \$ 1,024,500
Cost ¢/1000 Gal. 47.98¢

ESTIMATED TOTAL PROJECT COST

Joint Effluent Disposal by Agricultural Irrigation - All Three Towns

Agricultural Irrigation-Valley Site (Alternative R.A.I.V.)

	costs \$ (x 1000)		
	Capital	Salvage	O & M
A. Treatment - Gering (with Terrytown)			
Modifications to Existing Facilities	315	60	16
Diffused Air System & Operations Building	295	37	32
New Aerated Lagoon for Domestic Waste	254	37	75
Terrytown Pumping Station	33		5
Terrytown Force Main	40	20	
Chlorination			16
B. Treatment - Scottsbluff			
Modifications to Existing Facilities	197	38	22
Aerated Lagoon	385	57	108
Chlorination			22
C. Joint Effluent Disposal by Agricultural Irrigation - Valley Site			
1. Pumping station	396		37
2. Transmission	360	180	3
3. Storage pond	1,424	712	9
4. Distribution			112
5. Administration building and laboratory	120	60	25
6. Road, fencing, monitoring wells	16		23
	3,833		
Service factor (1.27) - engineering, administration, and contingencies	4,868		
Land	4,845	3,570	
	9,713	6,046	
- Present worth of salvage value (Including salvage value of Terrytown plant)	-1,570		
	8,143		505
D. Total Cost			
Project Cost	8,143		505
-Crop Benefits			11
Net Cost	8,143		494

Amortized Capital Cost \$ 768,400 per year
 Total Annual Cost \$1,262,600 per year
 Cost ¢/1000 Gal. 59.13 ¢

APPENDIX R
LETTERS REGARDING HISTORIC PRESERVATION

EXECUTIVE BOARD

ELECTED MEMBERS

Maurice S. Hevelone, President Beatrice
 Otto Kotouc, Jr., 1st Vice President Humboldt
 S. N. Wolbach, 2nd Vice President Grand Island
 Arthur Carmody, Treasurer Trenton
 Edwin J. Faulkner Lincoln
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 Warren C. Wood Gering
 Nellie Snyder Yost North Platte

MARVIN F. KIVETT
 DIRECTOR-SECRETARY



Phone 402/432-2793

EXECUTIVE BOARD

EX-OFFICIO MEMBERS

J. JAMES EXON, GOVERNOR
STATE OF NEBRASKA

DURWARD B. VARNER, PRESIDENT
UNIVERSITY OF NEBRASKA

PAUL W. WHITE, CHIEF JUSTICE
OF THE SUPREME COURT OF NEBRASKA

JACK POLLOCK, PRESIDENT OF
THE NEBRASKA PRESS ASSOCIATION

September 6, 1977

Claude T. Anderson
 Bell, Galyardt & Wells
 Architects - Engineers
 5634 So. 85th St.
 Omaha, Nebr. 68127

Re: Improving waste treatment facilities
 Gering & Terrytown, Nebr.
 HP #9-006-77

Dear Mr. Anderson:

The five alternatives for improving the Gering-Terrytown wastewater treatment facility has been reviewed by this office. Since those areas of highest potential for archeological or historical sites have been surveyed with negative results we feel that none of the alternatives would effect properties eligible for inclusion on the National Register of Historic Places. Therefore, additional surveys would not be necessary.

Sincerely,

Marvin F. Kivett
 State Historic Preservation Officer

Richard E. Jensen
 Preservation Archeologist

RECEIVED

SEP 1977

FIELD BRANCH
 WATER DIVISION



1500 R STREET LINCOLN, NEBRASKA 68508	
TO	WJW
✓	PRW
✓	CAH
	JWS
	SLH
	WHD
	SJD
✓	CR
	CH
	DP
	SOG
	SK
	W.D.
(751003)	
FILE NO. 770304	

Reproduced from
 best available copy.

RE: BGW No. 751003
Terrytown, Nebraska
BGW No. 750908
Gering, Nebraska

ARCHITECTS-ENGINEERS

Mr. Marvin Kevitt
State Historical Preservation Society
Lincoln, Nebraska

Page 2 September 1, 1977



Please indicate to us if any of these areas need a historical- archeological survey, and if so, why such a survey or additional survey work is required. If you have any questions, do not hesitate to contact this office.

Very truly yours,

BELL, GALYARDT AND WELLS, INC.

Claude T. Anderson

Claude T. Anderson

CTA:clg
Encl.

November 1, 1977

Architects - Engineers

Rapid City, So. Dak.
Omaha, Nebraska



Reply to: Omaha

Environmental Protection Agency
1735 Baltimore - Room 249
Kansas City, Missouri 64108

Re: Scottsbluff, Ne.
BGW File No. 770303

Att'n: Mr. Ralph Flournoy

Dear Mr. Flournoy:

In regards to your questions concerning the Historical/Archeological survey for the south irrigation site, we have enclosed the letter dated February 10, 1976 from Marvin Kivett, State Historic Preservation Officer. This letter refers to the archeological research done by Carl R. Falk on the south irrigation site for the City of Scottsbluff. Mr. Kivett's letter requests a field survey be completed prior to planned activities. We therefore had intended to have a field survey conducted prior to construction, if this site proved cost effective.

We have recently asked the State Historic Preservation Society whether the south irrigation site would need to be surveyed (Site 4) in our letter dated September 1, 1977. This was in regard to the joint Gering-Scottsbluff irrigation treatment system. Their response letter is dated September 6, 1977 and indicated it will not be required.

Enclosed are copies of the above referenced correspondence. If you have any questions please contact this office.

Very truly yours,

BELL, GALYARDT AND WELLS, INC.

Claude T. Anderson
CTA:jlj
Encl.

cc: Charles A. Haas

RECEIVED

NOV 03 1977

ENGINEERING BRANCH
WATER DIVISION

1026 Jackson Blvd.
Rapid City, So. Dak. 57701
Area Code (605) 343-5282

117 So. 2nd Street
Douglas, Wyoming 82633
Area Code (307) 358-5220

5634 So. 85th Street
Omaha, Nebraska 68127
Area Code (402) 331-0321

APPENDIX S
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